D1.1

User requirements

Editor(s)	Francesca Fracasso, CNR Gabriella Cortellessa, CNR	Project name	TV-based ASSistive Integrated Service to SupporT European Adults living with Dementia
Author(s)	Francesca Fracasso, CNR Gabriella Cortellessa, CNR Valentina Triantafyllidou, IMSD Diana Toma, AIA Flavia Boghiu, AIA	Acronym	TV-AssistDem
		Website	www.tvassistdem-aal.eu
		Task	T1.1
Reviewer(s)	Rodolphe Dewarrat, IMSD Valentina Triantafyllidou, IMSDFermin Mayoral, IBIMA	Nature/type	Report
		Dissemination Level	Public
		Delivery Date	31/04/2017
		Final Delivery	28/12/2017

Document History

Version	Date	Type of editing	Editorial
0.1	25/07/2017	Initial draft	State of the art and user requirements analysis
1.0	12/12/2017	Complete version revised	Revisions of User Requirements Priorities
1.1	27/12/2017	Input from IMSD	Input from IMSD included

Deliverable Summary

This deliverable describes an analysis of the clinical aspects to be considered in Mild Cognitive Impairment with specific emphasis on the cognitive training materials. The user requirements elicitation phase is also described with the specification of user requirements list for the TVASSistDEM and their level or priority.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Scope of the document and deliverable structure

The aim of this deliverable is to provide solid support to guide the technological development of the TV-AssistDEM solution. In fact, the TV-AssistDem project aims at developing a technological solution for extending the functionalities of a common household device, the TV, to improve the quality of life at home. The main target users are patients with Mild Cognitive Impairment (MCI) who stay at home, and their caregivers (formal and informal). In order to get an effective solution, a preliminary investigation of the clinical aspects and state of the art is necessary. Moreover, in line with a User Centered Design approach, the involvement of end users becomes necessary in order to address their needs and preferences.

For these reasons, the document is structured as follow: a first section is devoted to the description of a state-of-the-art aspects in Mild Cognitive Impairment. In this sense, a definition of this preliminary stage of dementia will be provided and an overview of the most common treatment approaches and involved actors will be also outlined. A second section is devoted to the presentation of the efforts carried out in order to elicit the user requirements by involving the stakeholders in focus groups performed in Spain and Romania. Finally, in the last section, the list of the resulting user requirements will be presented.

2 The TV-AssistDem key concept

A number of reviews can be found in literature which covers the topic of cognitive training and rehabilitation both in MCI and in Alzheimer Disease (AD) (i.e. Andrade & Radhakrishnan, 2009; Kueider et al., 2012; Choi & Twamley, 2013; Kallio et al., 2017). The rest of this section will outline some content from these essays.

2.1 Mild Cognitive Impairment

The term "Mild Cognitive Impairment" (MCI) has been introduced to fill the gap between regular aging and dementia. It refers to seniors with no severe limitations of daily functioning, who suffer however from mild cognitive deficit, potentially evolving into Alzheimer's Disease (Petersen et al., 1999; Petersen et al., 2001), with an estimated annual converse rate of MCI to dementia of about 11% (Mitchell and Shiri-Feshki, 2008).

The term MCI describes a set of symptoms, rather than a specific disease. A person with MCI has mild problems with one or more of the following:

- **memory –** for example, forgetting recent events or repeating the same question
- **reasoning, planning or problem solving** – for example, struggling with thinking things through

- **attention** – for example, being very easily distracted
- **language –** for example, taking much longer than usual to find the right word for something
- **visual depth perception –** for example, struggling to interpret an object in three dimensions, judge distances or navigate stairs.

The aforementioned deficits can be differently associated among each other and this can produce different typologies of MCI (Petersen et al., 2001; Petersen 2004):

- **MCI with memory deficit and impairment on other cognitive functions** (aMCI multiple domain),
- **MCI with deficit in one cognitive function, but memory** (non aMCI single domain),
- **MCI with deficit in more cognitive functions, but memory** (non aMCI multiple domain).

For people with MCI, these changes may cause them to experience minor problems or need a little help with more demanding daily tasks (i.e. paying bills, managing medication, driving). However, MCI does not cause major problems with everyday living. If there is a significant impact on everyday activities, this may suggest dementia (Petersen 2000).

Most healthy people experience a gradual decline in mental abilities as part of ageing. In someone with MCI, however, the decline in mental abilities is greater than in normal ageing. For example, it is common in normal ageing to have to pause to remember directions or to forget words occasionally, but it is not normal to become lost in familiar places or to forget the names of close family members.

In summary, the criteria for MCI cover a variety of aspects, such as:

1. *Concern regarding a change in cognition*. There should be evidence of concern about a change in cognition, in comparison to the person's prior level. This concern can be obtained from the patient, from an informant who knows the patient well, or from a skilled clinician observing the patient.
2. *Impairment in one or more cognitive domains.* There should be evidence of lower performance in one or more cognitive domains that is greater than would be expected for the patient's age and educational background. If repeated assessments are available, then a decline in performance should be evident over time. An impairment in episodic memory (i.e., the ability to learn and retain new information) is seen most commonly in MCI patients who subsequently progress to a diagnosis of Alzheimer's Disease.
3. *Preservation of independence in functional abilities*. Persons with MCI commonly have mild problems performing complex functional tasks they used to be able to perform, such as paying bills, preparing a meal, shopping at the store. They may take more time, be less efficient, and make more errors at performing such activities than in the past. Nevertheless, they generally maintain their independence of function in daily life, with minimal aids or assistance.

2.1.1 Treatment

Beside the pharmacological treatment, which usually foresees similarities to the treatment of Alzheimer's Disease (AD), **a number of neuro-cognitive techniques are used in order to decelerate the progression of the cognitive decline and the onset of dementia**. Considering the aim of the TV-AssistDem project and its possible services, this subsection will mostly focus on neuro-cognitive treatments. In fact, the developed solution aims to provide a valid tool for the clinicians for cognitive monitoring and administering of cognitive training. A review of the most common methods adopted for MCI patients will provide some insight intothe development of the solutions and services, which will be delivered during the clinical trials foreseen in WP4. As the prodromal phase of Alzheimer's disease and as such the logical target for early intervention (Andrade & Radhakrishnan, 2009), clinicians and researchers are paying more and more attention to the amnestic form of MCI (aMCI). Also, for this reason the following part will mostly focus on cognitive enhancement of amnestic deficits in patients.

Patients with AD more frequently show difficulties in encoding new information and implicit memory. On the other side, functions of storage and retrieval seem not to be affected (Kopelman, 1992). Neuroanatomical evidences supporting these findings show that medial temporal structures, like hippocampus, are those mostly involved in early stages of AD. These areas seem to be involved in processes of new episodic memories consolidation (Glisky, 1998), while it seems that semantic memory does not involve hippocampus. For this reason, diseases related to the medial temporal lobe are prevalently associated to deficit in the encoding phase of new information.

Primary prevention of MCI consists of all the factors related to a reduction in decline, for example, diet, education, physical exercise, mental activity, and the use of statins, and it has been suggested that a third of dementia cases might be preventable (Frankish and Horton, 2017) . Since drugs are of limited benefit, cognitive stimulation represents a significant opportunity for secondary prevention. Although, a recent review (Andrade & Radhakrishnan, 2009) has shown that until now few studies concerning rehabilitative intervention have been published, more recently, a recent report by the National Academies of Sciences, Engineering, and Medicine commissioned by the US National Institute on Aging (NIA) entitled Preventing Cognitive Decline and Dementia: A Way Forward have been published (2017).

Clare and Woods (2004) provide the first synthesis of cognitive enhancement in AD and grouped the various treatments into three broad categories: cognitive stimulation, cognitive training and cognitive rehabilitation.

Cognitive stimulation

It entails engaging the patient in discussions about common everyday tasks in an effort to stimulate mental activity (Cotelli et al., 2006; Davis et al., 2001; Tarraga et al., 2006). One cognitive stimulation technique commonly employed is "***reality orientation***" (Spector et al., 2000). As described by Spector et al. (2003) in their version of cognitive stimulation, a "reality orientation board" is used to display both personal and orientation information (group name, location, time, etc). Specific topics included on the board consist of using money, word games, present day information, and famous faces. The therapy focuses on repeatedly reminding patients of information using themes (such as childhood and food) in order to create continuity between different bits of information (Spector et al., 2010). All sessions allow the natural process of reminiscence, but also emphasize how the information relates to the current day (Spector et al., 2008).

Cognitive training

In contrast to cognitive stimulation, cognitive training (CT) is geared toward patients who have enough cognitive resources for a therapist or a computer program to guide them in scaffolded drill and practice of tasks designed to exercise specific cognitive functions or to work on relatively intact cognitive skills in order to support more impaired cognitive skills. CT is based on the premise of neuroplasticity, that practicing an isolated underlying cognitive skill has the potential to improve or at least maintain performance in a particular domain. There are computer-based cognitive training in AD using software packages that isolate and repeatedly train specific cognitive domains such as divided attention, spatial memory, or object discrimination. An example is the **Neuropsychological Training** (NPT), a software package that was originally designed for aphasia but modified for brain damage rehabilitation. It includes Domain-specific exercises targeted divided attention, object identification, sequential memory, working and spatial memory, visual discrimination (for faces), phonological discrimination and recognition, and verbal comprehension.

CT has also been combined with motor movements or practicing Activities of Daily Living (ADLs) to increase the procedural associations between learning an activity and remembering the steps involved. Another variation of CT, **Cognitive-Motor Intervention** (CMI) (Olazarán et al., 2004), combines practicing ADLs and cognitive exercises with cognitive stimulation techniques such as reality orientation.

Cognitive rehabilitation

Cognitive rehabilitation (CR) refers to a comprehensive cognitive enhancement program, wherein multiple training approaches are offered in a rehabilitation milieu setting. This model of inclusive treatment encompasses cognitive stimulation, cognitive training and other approaches, in the context of a biopsychosocial, individualized approach to understanding dementia (Clare et al., 2010). In CR, all facets of neuropsychological deficits are considered (and addressed) in the context of behavior and social functioning (Wilson, 2002). CR does not merely target specific cognitive abilities but offers a model of treating the cognitive decline on the basis of current behavioral and social disability. Cognitive gains are considered in the context of the interaction between the patient and the environment. In this respect, CR in AD does not only include models that emphasize restoring or halting cognitive deficits, but finding, learning, and practicing methods of compensating so that cognitive demands are minimized.

Metacognitive approach. Metacognition is defined as thinking about one's own thinking (Flavell, 1979), monitoring of our cognitive processes and setting goals for understanding and activating strategies. Initially created from a developmental perspective, it has also been progressively applied in the rehabilitation of adults (Bewick et al., 1995; Ownsworth et al., 2006). Metacognition is made up of two components. Metacognitive knowledge implies the knowledge people have about their cognitive abilities (e.g., memory, attention, etc.), their cognitive strategies, and the cognitive specific requests related to various typologies of cognitive tasks (e.g., shopping lists, appointments, etc.). Metacognitive regulation refers to cognitive monitoring (e.g., error detection) and processes of cognitive control (e.g., self-regulation strategies, conflict resolution, planning, error correction, etc.) (Nelson & Narens, 1990).

The training of strategies concerns learning, how to learn, and the acquisition of useful strategies (Berg, 1993; Schmidt et al., 2001). Rather than teaching tasks, it involves techniques for remembering or retrieving information and consists of specific rules that are given to patients and discussed with them.

In the following session a list of the most common cognitive techniques used for memory stimulation in AD patients.

Spaced retrieval. It is a learning technique which requires users to rehearse information to be learned at different and increasing spaced intervals of time or a set uniform amount of time (Haslam et al., 2011). Some examples of task can be the identification of objects, the face-name associations, spatial allocation of objects, and planning of daily actions (prospective memory) (Backman, 1996). In testing this type of learning, people are instructed to rehearse a given set of information at a certain time, and each new rehearsal is expected to have a longer period of time between itself and the previous rehearsal or an equal amount of time between rehearsals. At the end of every trial period there is a test phase.

Method of Vanishing Cues. This technique suggests that by giving letters as clues, people with dementia will be able to recall specific information. This method is particularly helpful when attempting to improve verbal memory or word finding abilities. It may be useful when attempting to learn names, addresses or information such as telephone numbers (Glisky et al., 1986). It consists of progressive reduction (backward chaining) of cues aimed at retrieving the information. It has been shown to facilitate cued recall.

Errorless Learning. It was an instructional design introduced by psychologist B.F. Skinner in the 1930s as part of his studies on what would make the most effective learning environment. Errorless learning refers to a method of learning novel things in an environment absent of errors (Clare and Jones, 2008). This method of learning aims to prevent the interference of the targeted stimulus to be learnt with mistakes that would otherwise be made. The use of an errorless environment in learning was first made on pigeons (Terrace, 1963a, 1963b) and subsequently further developed and studied for use in the rehabilitation of individuals with memory impairments (Baddeley and Wilson, 1994). During the encoding phase, the patient is asked to store information by making as few errors as possible. Preventing errors in the learning phase has been proven effective in improving learning itself in AD patients (Clare et al., 2000).

Verbalization and Visual Imagery technique. These methods require for the patients to verbalize visual information, or to make associations between a visual image and verbal information in order to facilitate the learning.

Moreover, *computerized techniques* represent an integrative instrument in conventional treatment of memory issues (Mazzucci & Malavita, 1993). There are evidences supporting their efficacy in the rehabilitation both of memory disease (Hoffman et al., 2003) and visuo-constructive abilities (Tarnanans, 2000).

2.1.2 Exercises for cognitive training

There have been researches on the effectiveness and eligibility of certain commercial serious games on people with MCI (McCallum & Boletsis, 2013 and Kazmi, Ugail, Lesk & Palmer, 2014). One should consider cognitive stimulation alongside physical exercise. Improvement of balance stability is related to better judgment and thus problem solving. Music and singing activities keep patients motivated and increase their responsiveness. The adaptation of ADL would help increase independence in everyday life. Activities which emphasize on speed of processing training improve cognitive performance and delay functional impairment (Edwardsa, Xub, Clarkc, Gueyd, Rosse & Unverzagtf, 2017). The cognitive exercises of the platform should ideally require minimum training in order to have low costs and be user-friendlier.

Despite promising facts, long-term or real benefits of cognitive exercises in the delay of dementia or improvement of patients with MCI remain controversial. Most games are furthermore intrusive, and the patient is constantly aware of being tested. Last but not least, cognitive decline is still possible, even if its effect is reduced.

The aim of the following table is to indicate the most successful types of cognitive games, allowing a comparison of advantages and disadvantages. The goal should be the implementation of cognitive exercises which maintain the following strengths but also lack the corresponding weaknesses.

Game	Targeted health area	Strengths	Weaknesses
BigBrain Academy	Cognition and behavior	• positive impact on depression, general behaviour, disposition • slows down cognitive decline	• positive impact on depression, general behaviour, disposition • slows down cognitive decline
WiiSports	Cognition and motor skills	• positive impact on depression, general behaviour, disposition • improves balance	• usability problems • complicated controller
computerized touch panel-type screening test	Cognition	• rehabilitation mechanism for cognitive impairment • an effective proven prediction and assessment function • less training required	• invasive (the user recognises the testing process) • predicts the disease only after a patient has become ill
WiiFit	Motor skills	• exercise freely and without supervision • better balance and gait	• expensive • batteries should be changed frequently

2.2 Aspects to consider in cognitive rehabilitation

Rehabilitation programs for dementia must take into account a progressively declining mental status, compromised brain systems involved in understanding or even being aware of the illness, and the increasingly apparent relationship between geriatric depression and dementia. Indeed, there are a number of neuropsychological and psychological obstacles when attempting to engage patients with AD in rehabilitation.

2.2.1 Cognitive deficits

The first and foremost obstacle is the most evident and may be the most pertinent one. The beneficial effects of rehabilitation are directly related to this degree of cognitive reserve. The significant impairments in episodic memory make it difficult to take in new information, which in essence, is the principal goal of rehabilitation – to learn new or more adaptive cognitive skills. Memory difficulties can also curtail self-efficacy, which can then lead to social withdrawal from activities and a complex relationship with depression, thereby exacerbating the diminishing capacity even further (Clare and Woods, 2004).

2.2.2 Denial/anosognosia

Quite commonly, patients deny the presence or severity of cognitive and functional impairments, despite palpable evidence to the contrary (Clare et al., 2004, Smith et al., 2000). Anosognosia has been described as a lack of awareness or insight into the illness, which may represent a defense mechanism, an impairment in the cognitive processes that support insight, or both. Macquarrie (2005) offers a unique perspective on how acknowledgement of the disease (and its eventual progression) is intertwined with paradoxical resistance to its inevitable final outcome. This resistance is expressed through denial and minimization as the patient attempts to maintain a sense of organization and competence when faced with a terminal illness. This denial may be at the core of non-adherence to cognitive rehabilitation and other treatments, and the relationship between denial and depression bears on this matter. When faced with advancing decline and life's finitude, patients recall events and achievements where they experienced competency and a sense of control. In stark contrast to this, their present lack of control over their cognitive abilities and functioning produces a profound loss of self-efficacy and anticipation for the future. In contrast, McGlynn and Kaszniak (1991) suggestedthat impaired awareness results from dysfunction of frontal lobe brain systems necessary for self-monitoring rather than defensive denial. The frontal dysfunction hypothesis in anosognosia continues to be a prevailing topic, given the commonality between AD and frontal dementia as both diseases progress (Seelaar et al., 2011). The frontal hypoperfusion associated with reduced awareness of deficits in brain injury has led some to suggest the existence of a hypofunctioning prefrontal pathway involving the right dorsolateral prefrontal cortex, inferior parietal lobe, anterior cingulate gyri and limbic structures in dementia (Amanzio et al., 2011). This network plays an important role in response inhibition, and AD patients who are unaware of their deficits exhibit impaired performance in response to inhibition tasks.

2.2.3 Depression/hopelessness

Depression is commonly reported in people with AD, from the early to advanced stages of cognitive and functional decline (Panza et al., 2010). The importance of considering depression is threefold: (a) depression can be a significant confounding factor in any type of cognitive rehabilitation program because it exacerbates or may be the cause of cognitive impairments rather than AD-related deterioration, (b) depression itself appears to be a risk factor for AD, and (c) regardless of etiology, depression can lead to a downward spiral of hopelessness. This highlights the importance of always considering depression in rehabilitation or any type of treatment for AD, as researchers try to identify effective strategies to delay the onset or slow the progress of dementia. Both depression and cognitive deterioration seem to have overlapping neuropathology and severe consequences, including diminished quality of life, functional decline, and disengagement from treatment services such as cognitive rehabilitation.

2.2.4 Defeatist beliefs

Defeatist beliefs are dysfunctional schemas that are automatically generated in response to feelings of hopelessness. These dysfunctional thoughts lead individuals to assume the worst outcome and contribute to a poor sense of self-competence that influences both mood and behavior, and thereby worsens already declining cognitive and functional abilities by preventing people from using even their more intact skills and abilities (Starkstein et al., 2005). Low self-efficacy and expectations of failure already play a fundamental role in governing goal-directed, task-centered behavior. Low self-efficacy is characterized by defeatist beliefs and refers to a lack of conviction in the ability to produce desirable consequences on a given task (Bandura, 2006). When considering factors that may influence patient response to cognitive rehabilitation programs within this population, the frequently reported feelings of hopelessness and defeatist beliefs (as manifested by low expectations of success) can have an adverse impact on the efficacy of cognitive rehabilitation, as these types of labor-intensive treatments require a high degree of task engagement. AD patients may be less inclined to actively engage in cognitive rehabilitation due to their beliefs that failure is inevitable. Defeatist beliefs may alter help-seeking behavior and perpetuate cognitive dysfunction by encouraging avoidance of potentially challenging treatment tasks. A lack of effort toward cognitive treatment can hinder not only performance on the specific training tasks, but more importantly, the ultimate outcome of treatment.

2.2.5 Task value

Another factor that contributes to poor treatment engagement is a person's understanding of the purpose behind, and the value of specific training tasks or treatment programs (Wigfield and Eccles, 2000). While some cognitive rehabilitation tasks have high face validity (e.g. practice remembering names), for many other tasks (e.g. sustained attention tasks that entail tracking a target across the screen), it may not be readily apparent to the patient how repeated practice may lead to important cognitive or functional improvements. In cases such as this, it is imperative that adequate justification for specific tasks is provided to the patients (perhaps repeatedly). For rehabilitation methods to be effective, patients must be adequately motivated to participate consistently in order to achieve adequate treatment intensity.

2.3   Target users

The importance to involve both the patients and caregivers in the treatment protocol has been frequently highlighted in literature (Martire et al., 2004; Mittelman et al., 2004; Woods, 2001). In fact, awareness of the links between adult physical illness and family relationships has led researchers to develop or modify patient focused psychosocial interventions to include the patient's family, most commonly the spouse (Keefe, Buffington, Studts, & Rumble, 2002). Similarly, psychosocial interventions have been developed specifically for the family member on whom the patient primarily depends for assistance and support (Schulz, O'Brien, et al., 2002; Sorensen, Pinquart, & Duberstein, 2002).

Although the goal of TV-AssistDem is not to provide clinical support to caregivers too, our hope is to provide relief to those caring of MCI patients by facilitating their living at home. For this reason, the stakeholders considered in the project are the MCI patients, their caregivers, and the health care professionals in charge of the patients.

3   User requirements elicitation

3.1   Objective and motivations

The main objective of the users' requirements elicitation phase was to gather feedback to better design the functionalities of the TVAssistDem platform. In fact, while the main aim of the system was already conceived at proposal time, the involvement of all typologies of users has been instrumental to guide and refine the definition of the various functionalities of the system. Users' involvement is crucial while designing innovative technology especially devoted to people with MCI. In this respect we recruited representative of the various users as will be described in the next section. Additionally, this investigation was aimed at identifying a level of priority of the various functionalities in order to plan the development of the tool for the clinical trial on the one hand and produce the commercial version at the end of the project on the other hand .

3.2   Method

A preliminary meeting with a psycho-geriatrician have been conducted, in order to gather insight for the development of a proper grid for leading the focus groups. Beside valuable information for a better refinement of the grid used in the focus groups, some insights for user requirements have been collected, thus contributing to the definition of the final user requirement's list.

Focus groups with patients and caregivers, and healthcare professionals were conducted in Spain and Romania in order to collect the perspective from users on their needs and what is important to observe to support independent living. A **focus group** is a form of qualitative research in which a group of people is asked about their perceptions, opinions, beliefs and attitudes towards a product, service, concept or idea (Stewart et al 2007).

The aim of the focus groups was to go through the platform services with the participants and elicit their discussion about possible services and functionalities, the best way of interaction and get some suggestion on the interface. Additionally, participants have been invited to express their opinions and feelings about technology as a supportive means for MCI management.

In Appendix 1 – Guidelines for focus group conduction the reader can find the grids followed during the focus groups with health care professionals and caregivers/patients.

3.2.1 Participants

Three types of participants have been recruited to get feedback from representatives of each category of users involved in the clinical trial foreseen in the TV-AssistDem project.

Some focus groups have involved health care professionals with specific expertise in dementia and cognitive decline, while others focus groups were dedicated to gather information from patients and their close caregivers (i.e. family members). More specifically, both in Spain and Romania, two focus groups with experts and two with patients and caregivers have been conducted. Detailed information on the participants are provided in Table 1 and Table 2.

Table 1 Participants in the 4 focus groups with experts in Spain and Romania

Spain 1 moderator, 2 observers		Romania 2 moderators	
Geriatricians	7	General practitioners	2
Registered General Nurse	7	Registered General Nurse	6
Neurologists	1	Medical Personnel Area Coordinator	1
General practitioner	6	Health Unit Receptionist	1
Social worker	1	Counselor	1
		Social worker	2
		Psychologist	1
		Formal Carer	5
		Kinesiotherapist	3
		Other	1
TOT.	22	TOT.	23

Table 2 Participants in the 4 focus groups with patients and caregivers in Spain and Romania

Spain 1 moderator, 2 observers, 2 external observers (neuropsychologist and psychologist)		Romania 2 moderators	

Patients	9 – 3 males, 6 females	Patients	21 – 5 males, 16 females
Caregivers	9 – 5 males, 4 females	Caregivers	3 – females
TOT.	18	TOT.	24

3.2.2   Procedure

At first the moderators started with a brief description of the project and explained to the participants the reason of the meeting and the expectations upon their participation.

Following this brief introduction, the moderators followed a discussion guide to generate interest in the topic, involve all the participants, and keep the discussion on track. One or more observers assisted the moderator. The role of the observer was to listen to the discussion, take notes and interact with the moderator when necessary. Notes from the observer could be used in directing the moderator in one way or another. Each focus group addressed a long discussion about the platform with a threefold goal: 1) investigating additional services tailored for mild dementia management; 2) gathering feedback for the redesign of the interface in order to make it accessible to the users with mild cognitive impairment; 3) gathering feedback for define the services provided by the platform.

In Figure 1 and Figure 2, the reader can have an idea of the setting kept during the focus groups, while participants had the possibility to familiarize and interact with the platform by themselves.

Figure 1 Focus groups in Spain.

Figure 2 Focus groups in Romania.

During the meetings, the moderators followed a guide and went through the platform by showing the main services already available, asking for feedback and for suggestions.

There was one discussion guide for the professional group and one for patients/caregivers with slight differences (discussion guides are reported in Appendix 1 – Guidelines for focus group conduction).

The focus group discussions were tape-recorded and transcribed verbatim.

3.2.3   Method of analysis

The aim of analysis was to identify examples and suggestions linked to the possible services provided through the platform. The specific point of view of users have been considered in order to gather any information strictly linked to the needs of people with MCI and their caregivers (both formal and informal). Additionally, any suggestions for a proficient interaction with the platform have been considered, especially with regard to the peculiarity of user interaction and interface's design.

A manifest qualitative analysis was used. This means that the analysis was close to the direct wordings in the text without deeper interpretation of latent meanings. The analysis was done by reading the text

back and forth to get a picture of how the participants talked about different aspects of the identified factors.

First of all, the text was read through to get a whole picture of the content. Secondly, suggested factors/services/comments that was mentioned by the participants was identified and marked in the text. The next step was to identify in the text if the focus group expressed that the marked data was an important factor to observe. If considered important, the suggested data was put in a table according to the following categories:

- General impressions
- Vital signs measurements
- Healthy habits (reminders)
- TV support (video conference with the doctor)
- Other applications
- General on the interface (interaction/graphics)
- Others

In the tables, one for health care professionals and one for patients/caregivers, the results are presented also supported by quotes from participants. The indication of the country where the results have been collected is also indicated.

3.3   Results

Health care professionals
General impressions
• The TV-AssistDem solution is seen as **a chance to bothbring patients and healthcare professional closer, and to deal with obstacles due to the health system**. "*I think the main reason for which I hope this project will have an impact is the fact that we will have an ally in our ruthless battle with the health system, that tries to always alienate the patient from us. And then maybe we will be able to reduce the distance between us and them*". Moreover, there is hope **to get financial benefits** for the system *"And maybe we can even prove that we can save some money by doing this"* (Romania)*.* • **The television conceived as the basis for the platform is seen as the best option considering the target patients**. *"…It is positive, since the elderly mostly do not use new technologies, but they do use the television"*; *"I think that in this type of population is quite adequate, since it is a technology with which they are familiar"*; "For *People with learning difficulties, including a new environment can be complicated. Can be a source of distress*" (Spain). • **Information included within the platform should be basic and it must be as easy as possible**, in order to make it easier for the patients to use it. "*I think it should contain the minimum indispensable elements that the patient will need for their use. All information that is not*

necessary to the patient for the use of the platform should be eliminated" (Spain); "*I think that the elderly tend to need more human support. They are not as familiarized with using technology as we might like to think. I think everything should be as simple as it can be, as clear as it can be, in order to have results*", "*Exactly! So, they need to easily find the information, because otherwise you lose your patience and you give up*" (Romania).

VITAL SIGNS MEASUREMENTS

- The participants found really useful the idea to get the possibility to take measurements and store data with the platform. **It would help to spare efforts both in home visits**: *"...would reduce some home visits, because sometimes professionals only go patients' home to monitor these vital signs to control some chronic pathologies*", **and hospitalization**: *"...Would also reduce patient visits to the hospital*" (Spain).

- **A training phase for the patients to be able to use the devices is considered as mandatory**. "*Patients must be trained beforehand so that measurements can be made properly, because inadequate technique for placement of the cuff, for example, may give incorrect data*" (Spain).

- Even more useful is the possibility to share such information in real time with the doctor, and this would make the patient to feel safer: "**I think it would be helpful because they could feel safer knowing that they have this option**" (Romania).

- A **text message is the easier way to receive information**. More specifically, **regular value could be notified through email, while abnormal ones through text message**: "*I think by email for the normal measurements and by text message if it is an alarming value*" (Romania).

- The **frequency of reception depends of the patients and his/her clinical history**: "*Of course if the patient has a respiratory disease, or maybe even cirrhosis, it's not necessary to take the blood pressure regularly. People with heart diseases have oscillating blood pressure; in their case, it is necessary to have the pressure monitored very often*" (Romania).

- The possibility to receive an **alert in case of abnormal values has been judged positively, but with caution**: "*That could be an extra option. Because it may be just a random value, in case the patient did not measure correctly, and then the system alerts us*" (Romania).

- Additionally, specialists in Romania **suggest not getting the patient notified if an abnormal value is detected, or at least considering the specific case**. Only the specialist should get information on the health status of the patient and then decide whether to communicate it to the patient, or the caregiver. Specialists are afraid that the patients could get panic is they see abnormal values: "*I'm afraid he/she might panic*", "*It depends on the person. Some can react badly, some may not. When we take the blood pressure for example we don't say the real value if it is a high value. If it's a really high number, we just take measurements*" (Romania). In Spain as well, some concerns have been raised with regard to this: "*This issue can generate a lot of distress in case the measurement is outside of range.*"

- **Family should be considered as recipients of notifications**, as well. In fact, it would be useful for a preliminary check on the patient's health status before calling the doctor: "*I was just going to say that this is a good idea. For example, if the parent is home alone, and there is an emergency, showing a number that is too high, the family can receive a text message. The family can then call him: Are you okay, what happened?*'' (Romania).

- It has been suggested to **provide support in taking the measurements also in terms of suggestions whether inconsistent data are gathered**. For example, "*A message could be sent to*

repeat the measurement making sure that all parameters have been taken into account for correct measurement (cuff placement, posture, rest before ...)" (Spain).

- It also emerged the importance to get a **tailored system according to the specific case**: *"...to be able to activate and deactivate different health parameters depending on the patient's profile*" (Spain). It should be **up to the doctor to decide which health's information can be available for the patient**. "*I think that only the medical team should have access to the data and also the patient, if he wants to, should have access but only if the doctor allows this, it depends from case to case. Because you, as a specialist, expert, can decide if it's good for the patient to know the values, or if the patient gets panicked easily....it depends from patient to patient*".

- With regard to the **graphic display of the measurement's trend, specialists think that it could be misleading**. "*But as a graphic that shows the values…this is also debatable. Because we may have a beneficiary that was a very intelligent person or…*" (Romania). It seems that **the way to convey such information should be tailored according to the level of patient's understanding**.

- With regard to the **'HELP' button** on the screen and its possible functions. Participants interpreted this as a **support in case of measuring an abnormal value and providing immediate simple health suggestions to the patients**: "*Let's say that if he has a high value of the blood pressure, he should rest a little bit, or sit on the chair, and then repeat the measurement*"; "*Or to drink water, because I understand that drinking a lot of water brings the blood pressure down, or not to panic*". Of course, this function should be available only for those patients who are allowed to get feedback on their measurements' output: "*Maybe for the people that do want to see their results, we should offer a series of information on: what to do if you see an abnormal value and so forth*". Some other suggest different type of **information, more focused on emergency calls**: "I think there should be information on contact numbers …emergency contact numbers", "*Yes, I think if they see a number to call in case of an alarming measurement maybe…or even family member's numbers*" (Romania).

- The **"HELP" button** could serve as **information provider in case the doctor is not available for feedback after a measurement**. "*Then, it would be better for the patient to receive information about his state, and then in the 'HELP' box he should be notified as to what can be done in terms of medication or blood pressure*". For this reason, the **information provided by the "HELP" button should be tailored according to the individual needs/pathology**: "*It helps if the patient knows the pathology. I think your (*i.e.: referring to the TV-AssistDem system*) help in terms of home care is good. I think that you have the patients' record, also the information given by the specialist on what should be done and the pathology; so, you can really take good care of the patient*". Spanish participants also suggest to: "*I believe that in case of measurement with data out of range this button should send a warning to the person who takes care of the patient, if it has*".

- When asked for additional **parameters worth to be monitored through the platform**, the Spanish participants provided some suggestions: "*In nursing, for example, in the follow-up of patients, the assessment by needs of Virginia Henderson*"; "It would be very useful to be able to monitor the **mood**"; "*I do not know how it could be done, but I think it would be very important to monitor the mood and quality of sleep for example. **Food** and **defecation patterns** too. We should take into account the comorbidities of the person, to design what to evaluate and individualize it*"; "*I think that they could also connect to the platform **sensors that measure physical activity** (pedometers for example)*" (Spain).

- Again, **the problem of a proper size of interface's content has been raised:** "*I think that the HELP*

button is very small. Because they usually have problems, either diabetes, or vision problems, they may have cataract and so forth. That Help button is of really great use in my opinion and they should see it better. It should be more visible", "*I think we are all used to write big so that everyone can see so I think they should be bigger*" (Romania).

HEALTHY HABITS (REMINDER)

- The reminder service has been **judged positively**: "*I think it's very good as a reminder, if he's watching a movie, say, he gets this message that he needs to take his medication*"; "*Yes, there are a lot of people that may be bedridden and I think something like this can help them;*" "*The patient sees that there is something written there... it may help him to take action*"; "*After you take the medication, there should be a STOP button, and to press ok*" (Romania)
- Nevertheless, **the possible intervention of the patients has been claimed**, i.e. "*He shouldn't be able to delete or postpone the reminder*", and the **carers should be the ones in charge of setting reminders**: "*I think the informal carers should be taught how to use the device and this particular functionality. But I think it depends from case to case. It may also require your help, as Institution, if the patient doesn't have a carer or if the family is away*" (Romania). On the other hand, "*I believe that the patient should be made as responsible as possible of his process, always with supervision, the more involved he is in the process, the better compliance I think he can have*" (Spain).
- **The disappearing of the reminder should be controlled by the patients**, in order to increase the chances to get it seen: "*I think there should be a button that the patient presses and that turns off the reminder. I think that if we let it disappear by itself the patient may not see it because he/she may be in the bathroom or somewhere else*" (Romania).
- Reminders should be set according to individual needs. Nevertheless, a **reminder for drinking water should be always present**. (Spain, Romania).
- The reminder for appointments should appear some time before, from three days to one hour before the actual appointment (Romania). In Spain a shorter time range has been suggested: "*They could appear the day before (not earlier, because it could cause confusion) and the same day*".
- Beside the visual reminder that appears when the TV is on, it is **mandatory to get other way to notify the patients by exploiting other means like sounds or lights**. "*Visual alerts could be accompanied with sound alerts*" (Spain); "*…a much stronger sound, because most of them are hard of hearing. We even have beneficiaries that do not hear the door bell and then they have these luminous signals in the house, that makes them aware of it*" (Romania).
- **Notifications on therapy adherence** would be appreciated by GP, specialists, and field workers (Spain).
- **Reminders on medication should be set by doctors, and registered nurses** (e.g. those professionals figures allowed to administered medication according to the national law) (Romania).
- In Spain a number of concerns to be addressed have been raised by the participants: "*How can you control that once the reminder has left the medication is taken? Or take it several times?*"; "*There is a risk that the patient may take the medication several times*"; "*It would have to take into account possible duplicities in the shots, or that the patient can indicate that the medication*

> *has been taken and not have done so*".

- Some **combined solutions in order to deal with the therapeutic adherence** have been suggested: "*I think that the alerts could be combined in these cases with the use of a pillbox, it could be indicated that the medication of the lunch for example (without specifying all the ones that would have to take it) and having it prepared previously in a pillboxer*" (Spain).

TV SUPPORT (VIDEO CONFERENCE WITH THE DOCTOR)

- This service has been considered as **useful**, both in Spain and in Romania. "*A virtual visit to the doctor would be very useful as a periodic evaluation and follow-up tool. You could do the interview, complete scales and evaluate the instrumental activities of daily life*"; "*It could be a way of giving them instructions or sending them specific information that would require both patients and relatives to avoid unnecessary visits to the hospital*"; "*It could also be a way to manage prescriptions, because sometimes patients or their caregivers only go to the hospital to solve some incidence with the prescriptions, if they could solve these incidents remotely it would be great*"; "*Even a neurological examination could be performed through the platform. I am not saying that it should replace the visits to the hospital, but a follow-up could be done*"; "*It would give important visual information (state of personal cleanliness, facial expression)*"; "*It could also be useful if a simultaneous videoconference is possible to make a group intervention (cognitive, of physical exercise)*" (Spain).

- This functionality can also be exploited in order to **allow the patient to leave messages to the doctor**: "*Yes, it is a really good idea, but the patients are usually scared if they feel any pain. So, they can leave a message to the doctor. Having a stomach ache doesn't necessarily mean that they need a consultation. And so, they can leave a message to the doctor, and the doctor can call them at a later time to discuss and offer a solution*". **These messages could be left via audio, i.e. voice**: "*if the doctor is not available, they can press the button to leave a message*", "*Audio and video. I doubt that they will write to the clinician*" (Romania).

- Health professionals see an **advantage also for caregivers** because: "*It can be a tool to help the caregiver, because one could get patient information remotely, which save you visits and increase your peace of mind and therefore your quality of life*" (Spain).

- At the same time the **TV-AssistDem platform could support patients to get in contact with others with their same situation**: "*It could also be useful for connecting with people in their same situation*"; "*the connection between patients could be beneficial, it could help them not to feel alone in this process, and to increase socialization in cases of patients who for some reason do not have a good social network*" (Spain).

- Someone suggested the possibility **of exploitation of the platform in order to make caregivers and doctors get in contact through it**: "*Would it be possible for professionals to contact caregivers? Sometimes it may be necessary*" (Spain).

- The presence of the camera supporting the communication with external persons is discussed, and **major privacy issues have been raised both in Spain and in Romania**: "*I think it should have a cover, like a small case. So, they control it, so they know that when they put the cover on, there is no LED bothering them*"; "*if there is no option to close the camera, the project will not succeed*" (Spain).

- **The patient should have control on the camera**: "*…if we will explain that they control the button, then they will have the control and they will then have more advantages that they can control*"

(Spain).
- There is the **risk for the patients to abuse of this service**: "*I want to say that some patients may call even if they suspect something is wrong. This should only be available if there is a real need, otherwise they could keep the doctor from a different task*" (Spain).
- Participants suggest **allowing the patients to know if the doctor is available for videoconference**: "*...integrated system in which the patient can see when the doctor becomes available and when he can take video calls. Patients are usually insistent, and they have free calls on their phones. But this is something else, that they need to understand*" (Spain).
- On the other hand, the **videoconferences can occur after having fixed and appointment** in order to avoid a misuse of this service and the possibility to get visible on the screen how many people are scheduled for the appointments (the queue of patients), it has been considered useful. "*That's okay then. It's actually helpful because they might organize their questions in their heads better*" (Romania).
- Some others claim the **importance for the doctor to be the one initiating the video calls**. " *The actual video calls are appointment based after all. So, the doctor knows he can call the patients. So why doesn't the doctor call the patients instead?*" (Romania).

OTHER APPLICATIONS

- In general, the interface should be simple, only the needed application should be present on the screen, and it must be simple and easy to use by the patient. **Few applications on the screen is the best option**. **Too much information can be confusing for the patients**. "If there are so many that we see now, I think that they won't even access this section. I mean they will think: We don't know what this is, so we don't use it at all" (Romania)
- Generally speaking, the applications considered as most useful for the patients are: **Cognition Games**, **Dictionary**, **Health Diet**, **Prospect for Medication**, **the press** *"…they may be able to use them, not all of them, but the Cognition Games will help, definitely. And also, the dictionary or where to look for their medication, or the healthy diet app. I think that in mild dementia, the loss of cognitive abilities is not that bad*". Additionally, through this app, the patient could have the possibility to get a sort of **map of hospitals, doctors' cabinet**, and to **fix medical appointments**, as well. "*I'm thinking here for an app with addresses…hospital addresses and clinician cabinets…like a map, a database*", "*I'm thinking about my parents. They are not that old, but they might not think to search on the Internet for these addresses and information about clinicians. So they might as well have an app here that shows them*", "*They can also gain access to the hospitals and clinics that take online appointments, and so they could apply straight from their homes*" (Romania)
- A crucial aspect is the one regarding the **patient's level of understanding**. Indeed, the **applications must be tailored for each case** (Romania).
- "*Home automation to control the patient at home, ensure patient safety in their home, adapt your environment to prevent falls*" (Spain)
- "*Connection with emergency services*" (Spain)
- "*It would be interesting that they could have access to information about services (eg associations). And general information, people in early states request information, it would be appropriate the platform lint to reliable sites*" (Spain)
- "*Health educational videos should be stored on the platform*" (Spain)

- They could be **represented in a more intuitive way to allow the patients to better understand the content**. "*…sorted by colors […] Something more significant, as an image*" (Romania)
- Other services are suggested like the **motion therapy**. Short videos "*with what they need to do. And there should be a schedule. Maybe they could do it together*" (Spain) (with the person in the video). Additionally, "*If the platform will remind them to do it, that would be fab*" (Romania).
- The **physical activity should be monitored by the platform** and an alert should be sent to the doctor informing him/her on the monitoring (Spain, Romania). Anyway, "*It's good if they* (e.d the patients) *are monitored a little bit, but not forced to do it*" (Spain).
- **A front-end for the caregiver could be useful in order to monitor the status of the patients**. "*The Platform is a good idea. You can log in and see every beneficiary, see who what has done and the text message only in case of an emergency*". In this way the doctor has the possibility to tailor the alerts, warnings, and information for each patients (Romania)
- It has been suggested to consider **recreational applications to be inserted in the platform**, **according with the patient's preferences and needs**. "*Music and cinema, personalizing the patient's tastes. Reminiscences, that personal photographs of patients can be stored*" (Spain).
- Another service that seems to be useful is those of **cognitive stimulation**, albeit some concerns emerged with regard the administering through the platform. "*Could be included in the platform Crosswords, brain stimulation games*"; "*I think interacting would be important for the stimulation in the accomplishment of the tasks, but it is difficult for the user to do it alone*"; "*I do not see it as useful for patients to do it alone, as a group or monitored by someone else, it would be more successful, especially because of the patient's initiative that is bored with doing things*"; "*Could be an interesting for people who have problems of accessibility to centers where cognitive stimulation is performed (associations, day care centers), or for people who do not want to go to these centers*" (Spain).

GENERAL ON THE INTERFACE (INTERACTION/GRAPHICS)

- An important factor to take into account is represented by the readability of the interface. For this reason, the **words should be displayed through the proper font size**. (Spain)
- **Voice commands should be considered as a means of interaction**: "*I think that a vocal command should be also available*" (Romania)
- The **interface should be as simple as possible**. **Few elements must be displayed**, and icons **should be big and simple** "*I think the left side (logo and camera) should only become visible when accessing that specific functionality. And so, the rest of the icons should be bigger. And also, the icons should be more specific*", "*See, they (the icons) are not all intuitive enough*" (Romania)
- When discussing the possibility to get pictures indicating the different applications of the platform, participants to the focus groups expressed **preferences with regard to writings instead of icons**: "*This informs me much better and I can remember. Even if the imageis big, I can understand better by reading. I can also inform other people, even an elderly person, would be something that I know how to communicate, explain, or give information*" (Romania). Experts involved in Spain suggests **combining text and icons**. "*Regardless of whether the text looks better or worse, I see it very appropriate to add icons to the texts*".
- In designing the interface, **special attention to the contrast between colors should be paid**.
- The **remote control** should have **bigger buttons**, and the **keyboard should be separated by it** "*I*

would just make it bigger. To be easier to use", "*I think it's hard to use but they will get used to it. But anyway, it's difficult to work with it*", "*I think the keyboard should be separate from the remote control and they should keep it separate only from when they need it*" (Romania)

- The remote control, especially with regard to **the QWERTYkeyboard, could be difficult to be used, also because of minor disabilities**: "*Yes, but if they have any minor disability they won't be able to use the qwerty function*" (Romania)

OTHERS
- The participants did **not find useful the possibility to use the web browser**, considering that the main part of their MCI patients are old people with no confidence with internet and technology. "*Usually elderly people in Romania are not used to this technology. They are not part of the Web generation. But if we teach them with patience we will convince them. But I think they will limit themselves to our information and what we tell them to do for their own well/being. We need to convince them that the system gives them a safety net and that they are well monitored for their own well-being.*" (Romania).   - The **remote controller is considered too difficult** for the patients to use and **the back section (those with the QWERTY) might be hidden**: "*There are too many buttons on the back, and it will take them ages to find the right one. The remote is rather big, but the buttons they use more frequently should be bigger*" (Romania); "*The use of the television remote control is very complicated at these ages, with or without dementia, in the normal control there are too many buttons that are not useful, to handle two controls can complicate it more, it would have to design something very simple to handle the platform*" (Spain).   - Someone suggested the **voice control as an easier way to interact with the platform**: "*I think it would be easier by vocal command. Because there will be visually impaired patients, and they can say….okay, what do I press now? And they don't see the buttons. They can even press and accidentally call the doctor*" (Romania); "*The possibility of a voice assistant for the management of the "SIRI" platform is considered*" (Spain).   - A **major concern regards the social isolation of the patients which possibly could be enhanced by the platform**: "*In my view, as you are posing, this system could cause the patient to have a problem of isolation, there are studies that demonstrate that electronic control can lead to non-socialization*" (Spain).   - For this reason, the experts recommend **not to rely exclusively on the platform with respect to the interaction between patients and doctors**: "*The platform would be a complement, face-to-face visits have to be done, this would be useful if someone on the other side is monitoring the patient's day-to-day*" (Spain).

Patients and caregivers
General impressions
The TV as a support for the TV-AssistDem system **seems to be the proper solution because of its ease of use and familiarity for older persons**: "*Now, with the new technologies, could be through a mobile of a Tablet, but through a television seems easier* […]*Television is something that more or*

less everyone drives, is something that is incorporated in our lives totally"; "*I think it's very good, that at home she [points to her relative] can use it with help, because otherwise it would not be possible. If it serves her and instead of seeing the television she is developing something that is more useful, it seems good to me*"; "*I see it great, because they spend many inactive hours, because before she [his mother] used to have hobbies but now she does not have them, if it helps to pass the time and to be doing useful things well*" (Spain – Caregivers)

- The possibility to get **personalized services** would be a very well appreciated aspect of the platform: "*It would be good for me, because I have two people with the same disease at home but with different symptoms, so maybe what works for them*"; "*I see it good, but it's the same with me, that if this is going to be personalized, because there are many levels, everyone will need something different*" (Spain – Caregivers)

- Some **concerns have been expressed with regard to the use of technology for frail people who are not used to it**: "*I think that people who are used to managing technologies and who are in initial symptoms, could take advantage of all this. Regardless of the age of the person, if you are not used to handling any type of device and you put this, I see it complicated. If they get lost inside the platform, I think they would turn it off and stop using it*" (Spain – Caregivers)

- The need for a **training services** has been asked for: "*Imagine that you start to handle it, you are wrong and you do not know how to continue, is there a place or someone who can help you in these cases?*". Or a sort of **continuous assistance**: "*If someone is telling you how to do it step by step, I think this could work*" (Spain – Caregivers)

VITAL SIGNS MEASUREMENTS

- **Positive comments** have been made with regard to the measurements of vital signs and **specifically with regard to the storage of such data**: "*It's okay that you don't have to keep track as before, by writing onto a paper all your data, daily*" (Romania – Patients)

- It has been considered **especially useful for those patients with chronic diseases** who need to get daily measurements, such as high blood pressure or diabetes. Referring to the Blood Glucose Meter a participant said: "*Oh, I think that one will be more useful. Especially for diabetics that need to measure their glucose daily, of course*" (Romania)

- In order to avoid an overload of information, **only the useful parameters for each patient should be considered in a tailored manner**: "*I think that in order not to saturate so much information, according to the health problems of the person should leave some icons and not others, if you do not have diabetics that does not leave that icon*" (Spain – Caregivers)

- It is **crucial the connection with a doctor**, more often with a **specialist**, in order to provide them with the measurements to be correctly interpret. Anyway, "*Firstly the family has to know, because the carer and the patient cannot take a decision*". For this reason, also families and informal carers should be notified about the health status of the patient. (Romania – Caregivers)

- Such information should be provided also to caregivers, but not with same urgency as for medication adherence. In fact, **the caregiver should get remote access to the platform in order to consult the measurements**: "*I do not think it is necessary that this information have to send us at the same time as it happens with the medication, the caregiver should be able to access to the platform to see the measurements at any time of the day*" (Spain – Caregivers). A different opinion has been expressed in care of **abnormal values, which should be notified to the caregiver**: "*But I think in the case of abnormal measure, it's good to know immediately*" (Spain – Caregivers).

- About the **'HELP' button**. It could provide instruction **on how to use the functions which are present on the screen**. This means that the content should be tailored according to what is shown at the moment: "*Instructions on how to use the screen. The blood pressure, for the blood pressure press button X. Maybe there are some that would like to read. And this should be it [...] for this function, press the green or the red button for example*". (Romania) In Spain it has been suggested that the HELP button could provide **information about the values measured**: "*The information on what blood pressure is correct*", "*Add a color according to the data of the blood pressure or give help and tell us if it is okay or not*", "*With a graph it informs you if it is good or not.*" (Spain – Caregivers).
- Participants asked for an **"alert function" in case of abnormal value detection**. **Audio alert is preferred** "*Audio never bothers, I'm sure of it. And it's also easier*". Anyway, some seniors might have hearing impairments, "*So it should be both text and audio for them*" (Romania)
- The best way to send alert is by **text message**. On the contrary: "*…the email… they only open it when they have some spare time, which can sometimes be rather seldom*" (Romania)
- Even if it is not possible due to legislative issues, many participants hope for a connection with 112 (the national emergency number) when an emergency is detected by the system.
- **Glycemia** (Spain – Patients) and **weight** (Spain – Caregivers) seem to be important parameters to keep monitored.
- The **data visualization through graphs** has been appreciated by participants, and the possibility to **send data directly to the doctor** as well: "*The graphic seems very useful visually. I have to take my blood pressure regularly, and I take it to the doctor written on a piece of paper, if they could get those data out of there or send them to me it would be wonderful*". This also means that **the doctor can have access to the data** and consult them. (Spain – Caregivers).

HEALTHY HABITS (REMINDER)

- Participants found this service a **really positive** one. "*This one is perfect!*" (Romania)
- Again, it emerges the **need to convey the information through different communication channels**. The reminder which pop up on TV is very useful, but **an audio message could be useful as well**. "*Because there might be seniors that can't read anymore but they can hear. I don't know how much they will understand. Some of them, might find it useful to have a ,,voice'' that reminds them to take their pill or whatever*" (Romania – Caregivers).
- **Especially if the TV is off, there is the need of some other type of alert**. Something like an audio signal. "Sing a bell" (Spain – Patient); Something that makes noise" (Spain – Caregiver).
- In fact, some **concerns have been raised in case of people who are not used to watch the TV** so much during the day time, because this service seems to be linked to the TV usage. "I also think that we should be many hours in front of the television to see the reminders. In my case there are days that I do not watch TV until late at night, I spend very little time watching television" (Spain – Caregivers)
- Additionally, the **message should be somehow "disturbing"** in order to really capture the attention: "*If you are very involved in this show, you may not pay much attention to the message that appears*"; "*Should stop the background image*"; "*When you put the reminder, I was so attentive to football that I did not realize it was a medication notice, I thought it was some publicity and I ignored it. I think that in order to be effective, it should be something uncomfortable, that bothers you and you have to remove it*" (Spain – Caregivers). "And *there*

should also be a sound when it comes on!" (Romania – Patients)

- **The disappearing of the reminder should be bonded to the vision of it by the patient**. "*Until that person has seen it. The patient should close it and then we are certain that he/she has seen it. It shouldn't close automatically!*" (Romania – Caregivers). It must be sure that the patient has seen it, or he has done what he was supposed to be reminded for. "*I believe that the message should not be removed until the patient takes the medication*" (Spain – Caregivers)

- **For the case of taking pills, the participants think that family members or close caregivers should be notified**: "*For the caregiver it would be a tranquility to know that he has taken it in some way*"; and the preferred means seems to be through a message on the mobile phone *"[…] with a message to the mobile for example. It's easy, a mobile is something that everyone has*". The suggestions from participants went also more in detail, and they suggested to **notify the reminder on the mobile** as well: "*the reminder that appears on the TV appears on the caregiver's mobile at the same time and disappears from the phone when the person removes it from the television. If it comes to us in real time we could be aware of whether it is or not the medication is taken*"; "*If it was linked with an application to the caregiver's device (smartphone or tablet or Pc), if it was similar to google, where you do something on the mobile and it is reflected in the computer at the moment ... it would be useful*" (Spain/Romania – Caregivers)

- There is also a suggestion for digital pills organizer which could be connected to the platform. (Spain/Romania – Caregivers)

- Nevertheless, **patients seem not to be convinced by the possible advantage of using the reminder function for the adherence to a pharmacological therapy**: "*I have my pillbox, diary, the night before, I prepare the medication for the next day*"; "*That's very good [the pillbox, e.d.]. It is revised, and if you see that something is full, you have not taken them. I see that better that television*"; "*We could not use it, because she would not be aware of the warning and since I am who give her medication, I do not see any use*" (Spain – Patients/Caregivers).

- **The possibility for the patients to set alarms by themselves seems not to be well seen** by the participants. (Romania – Caregivers)

- Another application of the reminder function has been suggested **for physical exercise, walking**: "*As medication´s reminders, make a reminder that you have to walk, that you have to answer every day to the TV if it has been done or has not been done*" (Spain – Caregivers).

TV SUPPORT (VIDEO CONFERENCE WITH THE DOCTOR)

- About the videoconference with a doctor, the participants expressed **very positive critics**: "*This is like a dream! I don't believe it!*", "*It's futuristic. But it's a good idea*", "*I think that this might appeal even to the doctors*", "*I see it very important that you can see the person and not just by phone*" (Spain/Romania – Caregivers/Patients)

- Participants gave some advices on the management of the video calls in order to **avoid a misuse and waste of time for doctors** "*Yes, and this phone call to the doctor need to be well done, because there are people that don't have anything to do, other than let's call the doctor, see what's new. And obviously they can't afford to waste their time on such situations*". (Romania)

- Participants suggested a call center which received the calls from patients and regulate them. (Romania)

- This service could also be used to make **calls to other persons close to the patients, like family members** (Romania). Otherwise, participants **discourage to allow different patients to**

communicate among each other through the platform: "*Yes, with the family, yes. But not with other patients. Because they might talk like...what pill has prescribed your doctor? This and that. Oh, I will go and buy that one as well!*" (Romania).

- With respect to the **camera**'s use during the video call, the **participants found it very useful because in this way the doctor can have more information about the patient's condition**: "*Yes, the camera is good, the doctor can see the skin color, or he may see other symptoms, God knows what*". (Romania – Caregivers).

- Nevertheless, some **concerns about privacy** emerged: "*You should have the option to close it, something physical that people see that is covered, because it will be installed in the house of people and some may not trust or are reluctant to have a camera in their home*" (Spain – Caregivers); "*The conversation that I am having with the doctor…is anyone else able to see it?*"; "*We are scared that someone else might see what we are doing*" (Romania – Patients)

OTHER APPLICATIONS

- The possibility to get additional services through other applications has **been considered very useful.** Anyway, the participants stressed the **need to get tailored services according to the specifics needs of the patients**: "*…depending on what they suffer from, they should get whatever they need*" (Romania – Caegivers); "*It should be possible to personalize, not to saturate information, so that each person could add what interests him or her*" (Spain – Caregivers). Additionally, **this section could be useful for carers as well**: *"…I think the ladies will start reading recipes, I mean I would, and the carers will start reading the First Aid section. Everyone reads what they need*" (Romania – Caregivers); "*That's very good, something that gives you more information for caregivers to help the patient, both in terms of diet, or how to care it. More information for the caregiver, to know how has to manage the disease*" (Spain – Caregivers).

- To get **information about a correct diet and cooking recipes** has been considered among the most important content for an application: "*The food, for the elderly is very important what they eat, recipes or meal guidelines. That there was access to menus or some type of information that should be eaten*" (Spain – Caregivers). **Tailored diet information** should be provided **according to the health status** of the person: "*Depending on whether you have hypertension, or diabetes, the platform shows what you should eat*" (Spain – Patients).

- Also, physical motion has been considered as a very important issue for patients, and it has been suggested to consider some applications with **exercise programs** (Spain – Caregivers). "**For example, walking according to the abilities of each one**" (Spain – Patients).

- The internet browser seems to be judged as somehow useful by the participants: "*Those are elderly, they are immobilized, they could use it. Yes, I think there would be some that will use it*" (Romania), except for people suffering from dementia, who cannot use it: "*1 out of 3 suffer from dementia, can't use it*" (Romania – Caregivers).

- **Information from the local community** (city council, health services, local activities), or **news, newspapers** could be provided through the platform.

- Within this section of the platform, some personal material should be included. **To get access to things like old photographs, preferred music and movies, old television programs** has been judged in a very positive manner by both patients and caregivers: "*It would be wonderful to be able to access old movies and songs*" (Spain – Caregivers); "*I like old music more than modern music*", "*in the memory workshops they put them (old movies and songs) on us, and we laugh a*

- *lot*" (Spain – Patients)
- Also, **memory exercises/games** (like **crosswords**, **sudoku, games to memorize couples**) can be put into this section, and they have been considered extremely useful. "*That's very important, that's the main thing. We do it in the workshops and at home*", "*It would be like homework, just as one would do at home doing it on the platform*" (Spain – Patients); "*I see it very useful*" (Spain – Caregivers).

GENERAL ON THE INTERFACE (INTERACTION/GRAPHICS)

- Participants found the **visual interface easy to understand**. **Colored icons have been appreciated**. "*I think it helps. Because when we want to click on something, we see the color first. If every function has its own color, it's fine then*"; "*It's good, they're good, to have a pictogram as well*" (Romania – patient).
- Anyway, **more attention has to be paid on contrast among color**s in order to make the interface more clear: "*As a suggestion, the contrast between the colors must be more pronounced, for example that white writing on that light blue is not very visible, at least from where I'm standing*" (Romania – patient); "*The green color should be darker so there is more contrast and it looks better*" (Spain – Patient)
- Additionally, it has been argued that, in order to make the platform fully accessible to older people, **the font size of text should be augmented**: "*For the elderly ones, the font size should be bigger as well. The text […] because eventually they will memorize the colors and go by them, but until they do, the font size should be bigger*" (Romania – Caregiver). **Or at least it should be adjustable according to the user's needs**. "*I have to put my glasses on to see it*" (Spain – Patient), "*I do not see it very well, but I have vision problems*" (Spain – Caregivers).
- The participants suggested to **adapt a mouse** as means to navigate on the screen instead of using the arrows on the remote control: "*Can we adapt a mouse? I think it will be easier by mouse*"; "*There is a cursor on the screen. But I think it's too complicated to use…*" (Romania)
- **The remote control is seen as too difficult to use**, especially with regard to the keyboard on the back. "*Oh, yes! But the keyboard is so tiny*", "*Oh, my God. If you haven't seen a computer before, you won't know how to use it*" (Romania); "*Keep it simple, it depends on the view of each one, it should be adapted*", "*I see the numbers, but I do not know what they are for*", "*Three buttons and nothing else*" (Spain – Caregivers/Patients). Additionally, there are some **concerns about the possibility to accidentally push some buttons on the keyboard**, ("*The keyboard should be as clear as possible. Let them see, that the numbers are not very small*" Spain – Caregivers) so it has been **suggested to cover it** "*…like a lid, to stay covered from possible clicks*", "*It should be hidden so as not to confuse people*" (Romania – Patients, Spain – Caregivers), or to make it more "*Anatomical, that does not slip, that the buttons are big. These buttons seem too flat to me, they do not stand out much*" (Spain – Caregivers).
- The icons on the screen devoted to the audio, camera etc. configuration "*They should be hidden so as not to confuse*" (Spain – Caregivers)
- Anyway, **the remote control is judged not impossible to use** "*We have to get used to it, but it takes time and patience*", unless "*…they have Prakinson!*" (Romania - Caregivers). For someone it seems pretty easy to use: "*That is not very complicated and that it is easy to press the keys, that it looks good, that the keys to which it is necessary to give are not too hidden*" (Spain – Patients).

• **Speech interaction** seems to be the preferred way to communicate with the platform "*Maybe vocal commands will help!*" (Spain/Romania - Patients), and also to consider a **touch screen** would be a solution (Spain – Caregivers).

OTHERS
• In general, patients seem to be **skeptical about their capacity to learn how to use the platform**, especially because they consider themselves too old: "*I am 88 years old and…. It gets harder and harder for me…*", "*So yes, it would be useful to be able to see our families through it, but I don't know if we can learn how to use it!*", "*Yes, I think it should be for younger people…maybe 50-year olds… but not 80 year olds…*" (Romania – Patients). For this reason, **special attention should be paid in training them and making the usage as simple as possible**.

4 User requirements

For each requirement the following information is provided:

Serial/Ref: an identifier of the User Requirement

Capability Descriptor: a brief textual description of the User Requirement

Requirement Statement: a more detailed description of the User Requirement

Justification References: A short reference to the motivations for the User Requirement and specifically the source that inspired it. In particular, the origin of each UR is specified through the country (Spain and/or Romania) and the end user category (HP = Healthcare Professionals, PaCg = Patients and Caregivers) from which the UR has been addressed).

Validation criteria: a statement suggesting how the User Requirement could be checked

Priority: the level of importance of the User Requirement in the range of **K**ey, **D**esirable, **O**ptional

The priority levels have been assigned considering two factors: the country (i.e. Spain and Romania) and the category of users (i.e. HP, PaCg) as follow:

Key= Requirements from both countries (Spain and Romania) and from both Categories in at least in one country.

Desirable: Requirements from both countries in at least one categories

Optional: All the remaining requirements

Serial/ Ref	Capability Descriptor	Requirement Statement	Justification References	Validation Criteria	Priority
1. Interface and user interaction					
1.1	*Ease of use*	*Information included in the platform should be basic, easy for the user.*	*RO – PaCg, HP* *SP – PaCg, HP*	The platform's layout should be simple, with few elements in order to avoid confusion to the user.	*Key*

				All information that is not necessary to the patient should be eliminated (i.e. just the useful applications must be displayed)	
1.2	*Accessible graphic interface*	*Interface should be accessible to frail users as well. Specific attention to visual impairment and age-related deficit should be taken into account.*	*RO – PaCg, HP* *SP – PaCg, HP*	Icons should be supported by text (especially those referring to the applications). Icons should be bigger (i.e. the help button, which is very important might be too small). Specific attention should be put in choosing bright colors and contrast between colors. The font size of the text should be appropriate to those with possible sight impairment. Few elements must be displayed and icons should be big and simple.	*Key*
1.3	*Audio interface*	*Visual input from the platform should be accompanied by audio feedback.*	*RO – PaCg, HP* *SP – PaCg, HP*	Especially for those who cannot read anymore, visual input should be accompanied to audio ones. Reminders should be both showed through the screen and convey as audio messages (see 5.5). Audio alert for abnormal values on physiological measurements.	*Key*
1.4	*Speech*	*Speech interaction could be used beside the use of the*	*RO – PaCg, HP*	The use of vocal command could help the patients in order to communicate with the	*key*

	interaction	*remote control*	*SP – PaCg, HP*	platform in a more proficient way.	
1.5	***Simplified remote control***	*The remote control is too complicated to be used as it is and it need to easier.*	*RO – PaCg, HP* *SP – PaCg, HP*	It would be better to have just the necessary buttons on it because too many buttons could be confusing for patient. Buttons might be bigger in order to facilitate the typing. The keyboard might be too complicated to use if the persons has never used a computer/typewriter. The keyboard is too tiny and there might be the risk of pushing buttons wrongly. It might be useful to cover it, may be with a sort of lid. The keyboard could also be separated from the remote control and it can be connected only whet it is needed.	***Key***
1.6	***To provide a mouse***	*The mouse could help the patient in moving the cursor on the screen.*	*RO – PaCg*	In order to facilitate the navigation on the screen a mouse could be easier to use instead of using the arrows on the remote control.	***Optional***
1.7	***Intelligent voice assistant***	*A voice assistant who support the patient in the platform's navigation*	*SP – HP*	A voice assistant could suggest the patients in interacting with the platform, for example by suggesting how to follow certain procedures, proactively guiding the patients through applications and services, etc..	***Optional***
2. Communication service					

2.1	Calls to the doctor regulation	Calls to the doctor should be regulated in order to avoid overwhelming the doctors.	RO – PaCg, HP	In order to avoid useless calls to the doctors, a system should be developed to regulate the calls. Dedicated time slots, the possibility to rely on a call center in order to filter calls Another solution could be to make the doctor responsible initiating the call, since it seems that the calls are appointment-based.	Optional
2.2	Socialization through the video call	The video call service could serve for maintain contacts between the patients and friends/family.	RO – PaCg SP – HP	The possibility to make the patients communicating with close persons is appreciated both by seniors and by caregivers. The possibility to initiate a call should be bidirectional. Anyway, it has been suggested not to allow patients to communicate among each other.	Desirable
2.3	Camera use	The use of the webcam is well judged, but some measures have to be taken in order to preserve the patients' privacy.	RO – PaCg, HP SP –HP	The usefulness of getting visual input during the video call has been recognized by every participant in order to get a richer framework of the patients' status. Nevertheless, the privacy issue must be taken into account, for example, by foreseeing a mechanism to cover it when not in use and that the patient can control.	Key
2.4	Back end for caregivers	Caregivers and doctors needs an access point in order to interact with the patient and to manipulate info on the	RO – PaCg, HP	On different sides the caregivers need to get access to the platform through a back end. Doctors and caregivers should have the	Optional

		platform.		possibility to check data gathered through physiological measurements, to fox appointments, manage reminders, etc.	
2.5	*Asynchronous communication*	*The patient could have the possibility to leave messages to the doctor through the platform.*	*RO – HP*	The patient could leave a message to the doctor with regard to minor issues. Then the doctor can check it and decide whether to get in contact with the patient and assess the degree of severity. The message should be recorded as an audio/video message.	*Optional*
3. Personalization issue					
3.1	*Tailored services*	*The additional services provided by the applications should be tailored according to the patient's needs and preferences.*	*RO – PaCg, HP* *SP – PaCg*	The applications should be chosen according to different aspects: the patient's health status (i.e. specific food recipes for patients suffering of diabetes), the patient's preferences, the needs of a caregiver who might be living with the patients (i.e. first Aid application). Useless information on the platform could produce confusion in the patients. For example, the internet browser has been judged as a useless service for people who are not used to it. Generally speaking, those considered more important are: Prospect for Medication,	*Key*

				Cognitive games, dictionary, Health diet,	
3.2	*Tailored available information*	*It should be up to the doctor the decision on which data can be available to the patients.*	*RO – HP* *SP – HP*	The doctors should have the possibility to activate/deactivate different health parameters depending on the patient's profile. The doctor should decide which information can access the patients.	*Desirable*
4.Vital signs measurements					
4.1	*Management of abnormal values*	*Proactive ability of the platform to suggest repeated measures to the patients in case of possible random abnormal values.*	*SP – HP*	*Abnormal values could be just a random event due to errors. The platform should proactively suggest the patient to repeat the measurements, possibly with further instructions, and just in case of repeated abnormal value send notification (see 4.2).*	*Optional*
4.2	*Notifications to doctors and caregivers of abnormal values*	*Abnormal values should be notified to the caregivers and doctors.*	*RO – PaCg* *SP – HP*	In case of abnormalities in physiological measurements, the caregivers should be notified. The preferred way of notification is by message on the mobile phone.	*Desirable*
4.3	*Prevent alarming patients from abnormalities on their measurements*	*Patient should not get notified in case of abnormalities.*	*RO – HP*	As far as possible, the patients should not be aware of abnormal values in their values, in order to avoid distress.	*Optional*

4.4	The "HELP" button providing different type of information	It should provide instruction regarding what is displayed on the screen at the moment.	RO – PaCg, HP SP – HP	The content of the "HELP" section should provide information in an "intelligent" way. I.e. instruction on how to proceed in order to make a certain operation (press the X button if you want to measure your blood pressure), or information on blood pressure if the patient is consulting it (if an abnormal value and the patient is allowed to see it, the help function could provide suggestions on how manage the situation like get a rest, drink water, etc.).	Key
4.5	Data visualization	Graphic data visualization should be tailored according to the degree of patient's understanding.	RO – HP	A graph could not be the proper solution for everybody since not everyone could be able to interpret it.	Optional
4.6	Mood status monitoring	Mood fluctuations should be monitored through the platform.	SP – HP	To get mood monitored could provide valuable insight for health care professionals in order to get a more complete picture of the patient's status.	Optional
5. Reminders and Appointments					
5.1	Controlled reminder disappearing and notification	It is important to check whether the patient has read the reminder once it pop up on the TV screen and to check that he/she has done what reminded by the platform.	RO – PaCg, HP	Until the person has seen the reminder, it must stay on the screen. For this reason, it must be a mechanism that enable the patient to confirm the reception of the messages. A "STOP" button to push, for example.	Optional

				At the same time, in case of taken pills, a notification should be sent to the doctor/caregivers.	
5.2	*Alarm setting*	*The possibility for the patients to set alarms by themselves should be regulated accordingly to the different cases.*	*RO – PaCg, HP* *SP – HP*	Patients should not have the possibility to set or postpone alarm by themselves. Unless they are supervised by someone. The possibility to involve them in the process might increase their compliance.	*Key*
5.3	*Drinking water reminder*	*Since dehydration seems to be a common issue in seniors, this should be a common reminder in the platform.*	*RO – HP* *SP – HP*	Although reminders should be tailored depending to the different cases, a reminder for drinking water should be always present.	*Desirable*
5.4	*Reminders' time setting*	*The platform should allow to set repeated reminders for appointments more times in advance.*	*RO – HP* *SP – HP*	The person who set the reminders should be able to set multiple reminders for an appointment from three days to one hour before.	*Desirable*
5.5	*Vocal reminders*	*Reminders should be both displayed on the screen and conveyed acoustically.*	*RO – HP, PaCg* *SP – HP*	In order to make the reminder more effective, it must also be provided through audio channel by producing acoustically the content (See 1.3).	*Key*
5.6	*Notification on therapy adherence*	*Notifications on therapy adherence would be appreciated by doctors, specialists and field workers.*	*RO – HP, PaCg* *SP – HP*	Therapy adherence is important and some suggestions have been provided in order to support it. For example, it has been suggested to combine the TV-A platform with a pillbox, maybe a digital one. This may help the patients in not failing to take their pills or	*Key*

				take the more times.	
6. Other services					
6.1	*Short educational videos*	*Additional services as videos can be included in the platform.*	*RO – HP* *SP – HP, PaCg*	Some suggestions are about health educational videos in general, like tutorials for physical mobility (a reminder could be also set in order to suggest the patients to do it).	*Key*
6.2	*Recreational applications based on reminiscences*	*Beside health focused services, some recreational services could be added.*	*SP – HP, PaCg*	Music, cinema, games, personal material such photographs could be included in the platform. Linked to UR#6.4.	*Desirable*
6.3	*Cognitive stimulation*	*Specific exercises for cognitive stimulation (memory exercises, games) could be included in the platform.*	*SP – HP* *RO –HP*	Exercises like crosswords and brain stimulation brain would be a good service administered through the platform. Nevertheless, patients would better benefit from them if supervised by an expert.	*Desirable*
6.4	*Reminiscences for cognitive status monitoring*	*Based on personal memories recall it can be used in order to monitor the cognitive status of the patient.*	*SP - HP* *IT – HP*	A database with personal material like photos, music, old tv programs or movies. Random questions based on biographic history of the patients can be administered through the platform and a notification sent to the caregiver if abnormalities are detected.	*Desirable*
6.5	*Healthy diet*	*Among different applications,*	*SP – PaCg*	Healthy recipes, possibly personalized	*Desirable*

		there should be one devoted to providing healthy dietary habits.	RO – HP	according to the patient's health status would be desirable.	
6.6	Social service connection's links	Some links to community services could be provided within this section.	SP – HP RO – HP	Logistic information on health services in the territory (hospitals location, doctor's cabinet timetables, etc.) Additionally, news from municipality, news from local events, etc.	Desirable

5   References

Amanzio M, Torta DME, Sacco K, Cauda F, D'Agata F, Duca S, Leotta D, Palermo S, Geminiani GC. Unawareness of deficits in Alzheimer's disease: role of the cingulate cortex. Brain. 2011; 134:1061–1076.

Andrade C, Radhakrishnan R. The prevention and treatment of cognitive decline and dementia: an overview of recent research on experimental treatments. Indian J Psych. 2009;51(1):12-25.

Backman L. Memory training and memory improvement in Alzheimer's disease: rules and exceptions. Acta Neurol Scand 1992;39(Suppl 1):84-9.

Backman L. Utilizing compensatory task conditions for episodic memory in Alzheimer's disease. Acta Neurol Scand 1996;165(Suppl):109-13.

Baddeley AD, Wilson BA (1994). When implicit learning fails: amnesia and the problem of error elimination. Neuropsychologia 32:53 68.

Bandura A. Going global with social cognitive theory: From prospect to paydirt. Applied psychology: New frontiers and rewarding careers. 2006:53–79.

Berg I. Memory Rehabilitation for Closed—Head Injured Patients. Groningen, The Netherlands: Rijsuniversiteit; 1993.

Bewick KC, Raymond MJ, Malia KB, Bennett TL. Metacognition as the ultimate executive: techniques and tasks to facilitate executive functions. NeuroRehabilitation. 1995;5(4): 367-375.

Choi J, Twamley EW (2013) Cognitive rehabilitation therapies for Alzheimer's disease: A review of methods to improve treatment engagement and self-efficacy. *Neuropsychological Review* **23**, 48-62.

Clare L, Jones RSP (2008). Errorless learning in the rehabilitation of memory impairment: a critical review. Neuropsychol Rev 18:1 23.

Clare L, Jones RSP (2008). Errorless learning in the rehabilitation of memory impairment: a critical review. Neuropsychol Rev 18:1 23.

Clare L, Linden DEJ, Woods RT, Whitaker R, Evans SJ, Parkinson CH, van Paasschen J, Nelis SM, Hoare Z, Yuen KSL, Rugg MD. Goal-Oriented Cognitive Rehabilitation for People With Early-Stage Alzheimer Disease: A Single-Blind Randomized Controlled Trial of Clinical Efficacy. American Journal of Geriatric Psych. 2010; 18:928–939.

Clare L, Wilson BA, Carter G, Breen K, Grosses A, Hodges JR. Intervening with everyday memory problems in dementia of Alzheimer type: an errorless learning approach. J Clin Exp Neuropsychol 2000;22:132-46.

Clare L, Wilson BA, Carter G, Roth I, Hodges JS. Relearning face-name associations in early Alzheimer's disease. Neuropsychology 2002;16:538-47.

Clare L, Woods B, Moniz Cook ED, Orrel M, Spector A. Cognitive rehabilitation and cognitive training for early stage Alzheimer's disease and vascular dementia (Cochrane Review). In: The Cochrane Library. Chichester, UK: Wiley e Sons, Ltd. Issue 2, 2004.

Clare L, Woods RT. Cognitive training and cognitive rehabilitation for people with early-stage Alzheimer's disease: A review. Neuropsychological Rehabilitation. 2004; 14:385–401.

Cotelli M, Calabria M, Zanetti O. Cognitive rehabilitation in Alzheimer's Disease. Aging clinical and experimental research. 2006; 18:141–143.

Davis RN, Massman PJ, Doody RS. Cognitive Intervention in Alzheimer Disease: A Randomized Placebo-Controlled Study. Alzheimer Disease & Associated Disorders. 2001; 15:1–9.

Flavell JH. Metacognition and cognitive monitoring: a new area of cognitive development inquiry. Am Psychol. 1979;34(10): 906-911.

Frankish H., Horton R. Prevention and management of dementia: a priority for public health. The Lancet, Vol. 390, No. 10113

Glisky EL. *Differential contribution of frontal and medial temporal lobes to memory: Evidence from focal lesions and normal aging*. In: Raz N, ed. *The other side of error term*. Amsterdam: Elsevier Science 1998:261-317.

Glisky, E. L., Schacter, D. L., & Tulving, E. (1986). Learning and retention of computer-related vocabulary in memory impaired patients: Method of vanishing cues. Journal of Clinical and Experimental Neuropsychology, 8, 292-312.

Haslam, C., Hodder, K., & Yates, P. (2011) Errorless learning and spaced retrieval: How do these methods fare in healthy and clinical populations? Journal of Clinical and Experimental Neuropsychology, 33(4), 432-447.

Hofmann M, Rosler A, Schwarz W, Muller-Spahn F, Krauchi K, Hock C, et al. *Interactive computer-training as a therapeutic tool in Alzheimer's Disease*. Compr Psychiatry 2003;44:213-9.

Kallio, E. L., Öhman, H., Kautiainen, H., Hietanen, M., & Pitkälä, K. (2017). Cognitive Training Interventions for Patients with Alzheimer's Disease: A Systematic Review. Journal of Alzheimer's Disease, 56(4), 1349-1372.

Keefe, F. J., Buffington, A. L. H., Studts, J. L., & Rumble, M. E. (2002). Behavioral medicine: 2002 and beyond. *Journal of Consulting and Clinical Psychology, 70,* 852–856.

Kopelman MD. Storage, forgetting and retrieval in the anterograde and retrograde amnesia of Alzheimer dementia. In: Backman, ed. Memory functioning in dementia. Amsterdam: Elsevier Science 1992;89:45-72.

Kueider AM, Parisi JM, Gross AL, Rebok GW (2012) Computerized cognitive training with older adults: a systematic review. PLoS ONE 7: e40588.

Macquarrie CR. Experiences in early stage Alzheimer's disease: Understanding the paradox of acceptance and denial. Aging & Mental Health. 2005; 9:430–441.

Martire, L. M., Lustig, A. P., Schulz, R., Miller, G. E., & Helgeson, V. S. (2004). Is it beneficial to involve a family member? A meta-analysis of psychosocial interventions for chronic illness. *Health psychology*, *23*(6), 599.

Mazzucchi A, Malavita A. Quali le indicazioni e i limiti della riabilitazione computerizzata? In: Ager A, ed. Il Personal computer in psicologia clinica. Milano: Raffaello Cortina Editore 1993:150-4.

McGlynn SM, Kaszniak AW. When Metacognition Fails: Impaired Awareness of Deficit in Alzheimer's Disease. Journal of Cognitive Neuroscience. 1991; 3:183–187.

Mitchell, A.J., Shiri-Feshki, M. Temporal trends in the long term risk of progression of mild cognitive impairment: a pooled analysis, J. Neurol.Neurosurg. Psychiatry 79 (2008) 1386–1391.

Mittelman, M. S., Roth, D. L., Coon, D. W., & Haley, W. E. (2004). Sustained benefit of supportive intervention for depressive symptoms in caregivers of patients with Alzheimer's disease. *American Journal of Psychiatry*, *161*(5), 850-856.

Nelson TO, Narens L. Metamemory: a theoretical framework and new findings. In: Bower G, ed. The Psychology of Learning and Motivation. Vol 26. New York, NY: Academic Press; 1990.

Olazarán J, Muñiz R, Reisberg B, Peña-Casanova J, del Ser T, Cruz-Jentoft AJ, Serrano P, Navarro E, García de la Rocha ML, Frank A, Galiano M, Fernández-Bullido Y, Serra JA, González-Salvador MT, Sevilla C. Benefits of cognitive-motor intervention in MCI and mild to moderate Alzheimer disease. Neurology. 2004; 63:2348–2353.

Ownsworth T, Fleming J, Desbois J, Strong J, Kuipers P. A metacognitive contextual intervention to enhance error awareness and functional outcome following traumatic brain injury: a singlecase experimental design. J Intern Neuropsychol Soc. 2006; 12(1):54-63.

Panza F, Frisardi V, Capurso C, D'Introno A, Colacicco AM, Imbimbo BP, Santamato A, Vendemiale G, Seripa D, Pilotto A, Capurso A, Solfrizzi V. Late-Life Depression, Mild Cognitive Impairment, and Dementia: Possible Continuum? American Journal of Geriatric Psych. 2010; 18:98–116.

Petersen RC, Smith GE, Waring SC, Ivnik RJ, Tangalos EG, Kokmen E. Mild Cognitive Impairment: clinical characterization and outcome. Arch Neurol. 1999 Mar; 56(3): 303-308

Petersen RC, Stevens JC, Ganguli M, Tangalos EG, Cummings JL, DeKosky ST. Practice parameter: early detection of dementia: mild cognitive impairment (an evidence-based review). Report of the Quality Standards Subcommittee of the American Academy of Neurology. Neurology. 2001 May 8;56(9):1133-1142.

Petersen RC. Mild cognitive impairment as a diagnostic entity. J Intern Med. 2004 Sep; 256(3): 183-94.

Petersen RC. Mild cognitive impairment: transition between aging and Alzheimer's disease. Neurologia. 2000 Mar; 15(3): 93-101.

Schmidt IW, Zwaagstra R, Berg IJ, Deelman BG. Memory strategies of elderly: training efficacy. Tijdschr Gerontol Geriatr. 2001; 32(2):54-61.

Schulz, R., Draper, R. A., & Rollman, B. L. (2002). Depression as a risk factor for non-suicide mortality in the elderly. *Biological Psychiatry, 52,* 205–225.

Seelaar H, Rohrer JD, Pijnenburg YAL, Fox NC, van Swieten JC. Clinical, genetic and pathological heterogeneity of frontotemporal dementia: a review. Journal of Neurology, Neurosurgery & Psychiatry. 2011; 82:476–486.

Smith CA, Henderson VW, McCleary CA, Murdock GA, Buckwalter JG. Anosognosia and Alzheimer's Disease: The Role of Depressive Symptoms in Mediating Impaired Insight. Journal of Clinical and Experimental Neuropsychology. 2000; 22:437–444.

Sorensen, S., Pinquart, M., & Duberstein, P. (2002). How effective are interventions with caregivers: An updated meta-analysis. Gerontologist, 42, 356–372.

Spector A, Orrell M, Woods B. Cognitive Stimulation Therapy (CST): effects on different areas of cognitive function for people with dementia. International Journal of Geriatric Psychiatry. 2010; 25:1253–1258.

Spector A, Woods B, Orrell M. Cognitive stimulation for the treatment of Alzheimer's disease. Expert Review of Neurotherapeutics. 2008; 8:751–757.

Starkstein SE, Jorge R, Mizrahi R, Robinson RG. The construct of minor and major depression in Alzheimer's disease. Am J Psychiatry. 2005; 162:2086–2093.

Tarnanas I. A virtual environment for the assessment and the rehabilitation of the visuo-costructional ability in dementia patients. Stud Health Technol Inform 2000;70:341-3.

Tárraga L, Boada M, Modinos G, Espinosa A, Diego S, Morera A, Guitart M, Balcells J, López OL, Becker JT. A randomised pilot study to assess the efficacy of an interactive, multimedia tool of cognitive stimulation in Alzheimer's disease. Journal of Neurology, Neurosurgery & Psychiatry. 2006; 77:1116–1121.

Terrace HS (1963a). Errorless transfer of a discrimination across two continua. J Exp Anal Behav 6:223 232.

Terrace HS (1963b). Discrimination learning with and without 'errors'. J Exp Anal Behav 61:1 27.

Wigfield A, Eccles JS. Expectancy–Value Theory of Achievement Motivation. Contemporary Educational Psychology. 2000; 25:68–81.

Wilson BA. Towards a comprehensive model of cognitive rehabilitation. Neuropsychological Rehabilitation. 2002; 12:97–110.

Woods, R. T. (2001). Discovering the person with Alzheimer's disease: cognitive, emotional and behavioural aspects. *Aging & Mental Health*, *5*(sup1), 7-16.

6   Appendix 1 – Guidelines for focus group conduction

6.1   Health care professionals

Discussion guide, health care professionals

(please, remember to audio/video record the meeting and, if possible, to take some photos)

NOTE: Keep in mind that the focus group has a threefold goal: 1) investigating additional services tailored for mild dementia management; 2) gathering feedback for the redesign of the interface in order to make it accessible to the users with mild dementia; 3) gathering information to build up the back end for caregivers (both formal and informal). By now we do not know anything about whether they want to have remote access to information gathered by TV-AD, how or when.

Try to get a feedback on the level of importance about the information retrieved, this will be important to give priority to the requirements.

Start with a short description of the project
Aim of TV-AssistDem is to develop a technological tool to facilitate remote support to patients affected by mild dementia, exploiting TV-based transmission of data and video-interactivity between health-professionals, patients, caregivers and family members.
A key point of the project is the utilization of relatively simple technological solutions which the users are already familiar with, to minimize the learning curve impact on the daily life of the elderly who still lives at home". Indeed, the project envisages the utilization of tools accessible to pre-digital divide people, through the creation of a dedicated digital TV channel capable of supporting: (a) an interactive videoconference service with health professionals; (b) a flexible agenda and reminder system so as to foster therapeutic adherence; (c) ordinary telecare through remote transmission of vital signs data (e.g. blood pressure) and regular monitoring of cognitive functions; (d) social connectedness of patients with their families, to community organizations and to social services. In addition, the system aims at promoting a healthy lifestyle of people living with dementia at home, through counseling, exercise training by videos and online practice sessions.

*Continue with explanation on what we expect from participants during this meeting*
During this meeting I will show you a tool already existent. And we will explore it step by step in the attempt to design together the better way to enhance it for the specific usage with people affected by Mild Dementia.
It is important for us to get insights from your professional point of view in order to understand how to exploit this tool serving your work, and taking the cue from your specific expertise in order to enrich it with additional services, which are common in clinical practice.

| |
|---|
| Participants: |
| HOME SCREEN
→ Show the home screen, provide a brief description and start with general considerations.
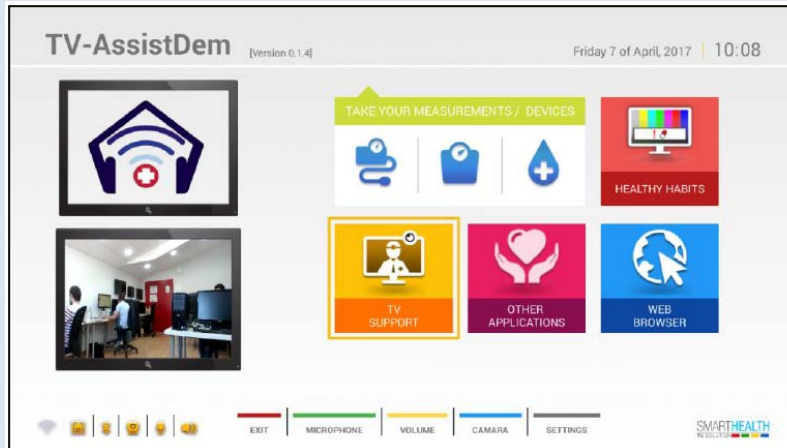
 |
| Questions |
| First impressions after the presentation of the project, what do the participants think?
PROBES →
    o General comments about the idea → support through TV, potential for clinical practice, etc.
    o General feedback about the graphic interface → Considering the target users, do you think that some particular rules should be followed in building the layout? Colors, font size, information organization, etc. Is it the organization of information on the screen enough clear? Would you change something? |
| <div align="center">**SERVICES ALREADY EXISTENT ON THE PLATFORM**</div> |
| VITAL SIGNS
→ show demo for blood pressure measurement (pay attention so that the video does not stop, you have to turn off the sound)
    o It is only possible to show the history of measurements (diary)

 |
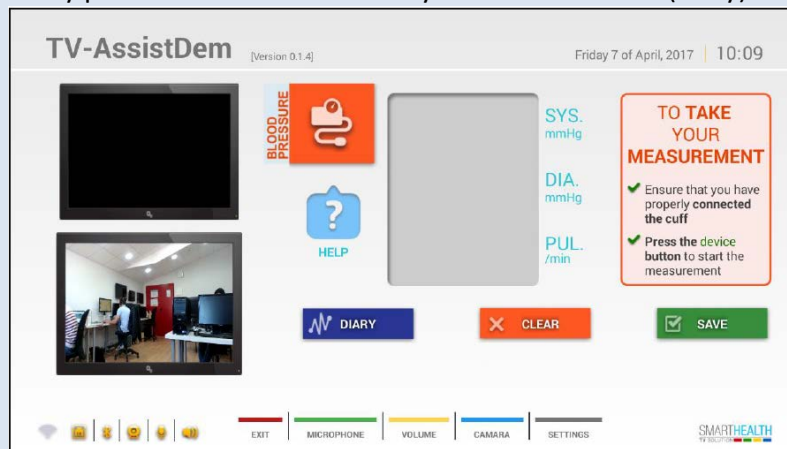
Questions

This is what the old person can see about vital signs measurements.
What about the graphical interface?
PROBES →

- o Any suggestion for improvements according to patient's needs? What about colors, font size, information displayed on the screen, etc.

Would you like to get this information?
PROBES →

- o Through which channel? E-mail, sms, etc.
- o In which form? Graphs, tables, etc.
- o When? How often: weekly, monthly, etc?
- o And what about the possibility to get alerts when some abnormal value is detected?
- o The "help" button. Which type of help do you think the person with MD could need?

HEALTHY HABITS (REMINDER)
→ show demo (the reminder appears when the right/left arrow on the remote controller is pushed.
Push more than once to show both medications and appointments reminder) some reminder can
be sent while the person watches the tv.
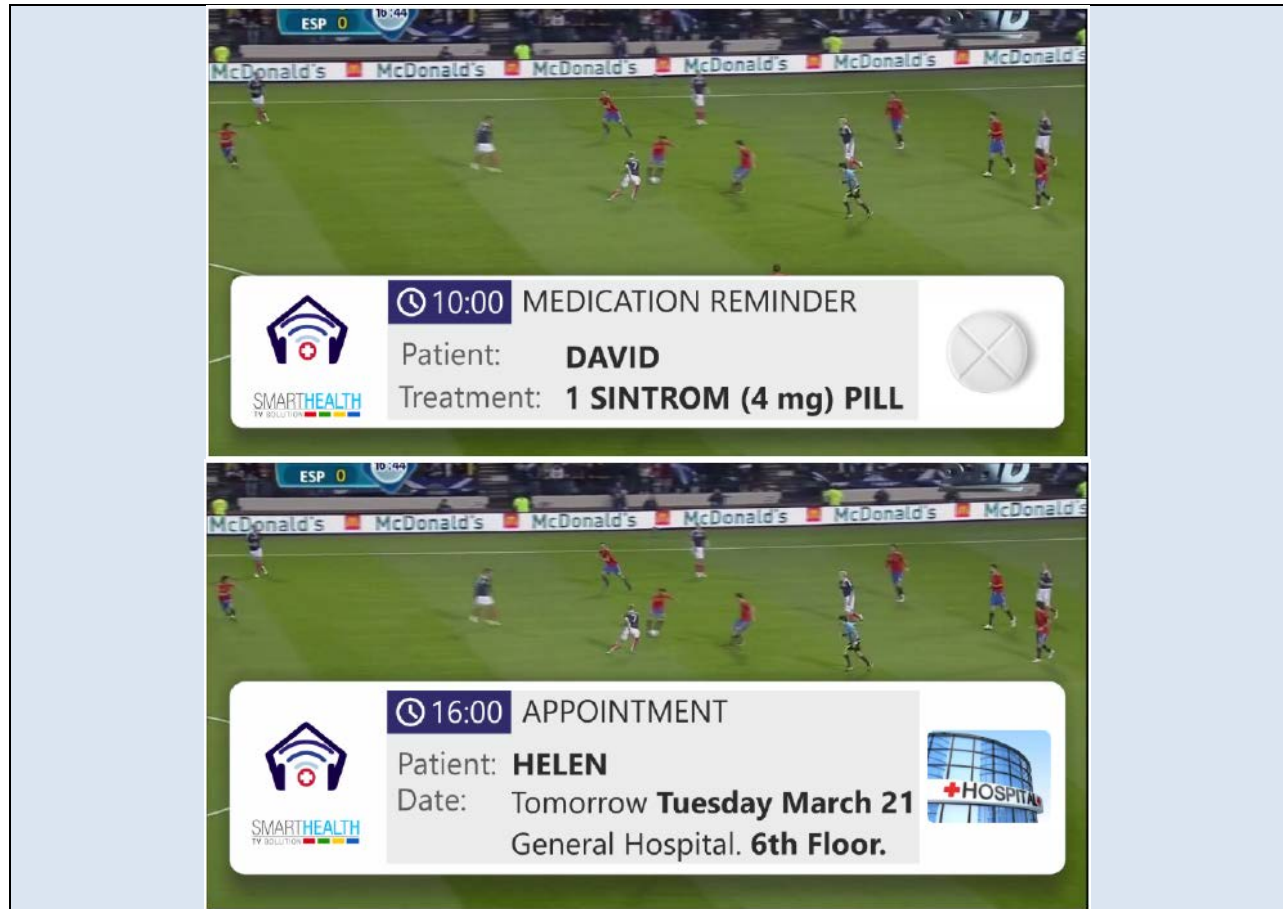
Questions

What do you think about this service?
PROBES →
- o Do you think that the pop-out can work properly? Do you suggest any other way? Sounds, freezing the tv show when a reminder appears, etc.
- o Do you think that a check on taken medication should be needed? Through which form? i.e. the pop-out disappear only after the patient takes the pills and confirm it

From your side, as a doctor, do you need any kind of confirmation?
PROBES →
- o For example, a confirmation that a pill has been taken, or that a reminder for appointment has been checked.
- o Alerts when pills are not taken, or for missed appointments, etc.
- o What about periodical report on the patient's habits, instead of punctual alerts?

By now appointments/reminder can be set by other people (the doctors) but the patient. What about this?
PROBES →
- o Other people should be able to do it? Who? With regard to which type of reminder?
- o Do you think that it could be useful to provide the possibility for the patient to set himself

| some reminder? Which could be the best way? Message recording, typing a text, etc. |
|---|
| TV SUPPORT (VIDEO CONFERENCE WITH THE DOCTOR).
(Enter this section) Ideally, the patient can get virtual appointments with the doctor.

 |
| Questions |
| What do you think about this service?
PROBES →

  o The possibility to get virtual visits to your patients would provide added value to your practice?
  o What about the information displayed? Do you think they are easy to understand?
  o Do you have any suggestion for an improvement of this service according to the specific needs of this kind of patients? |
| OTHER APPLICATIONS
→ other services can be delivered according to the specific need of MD patients. Enter the section. Some examples are provided. A tool like TV-AssistDem could be useful as support for management of MD issues, and it could somehow serve your clinical practice.
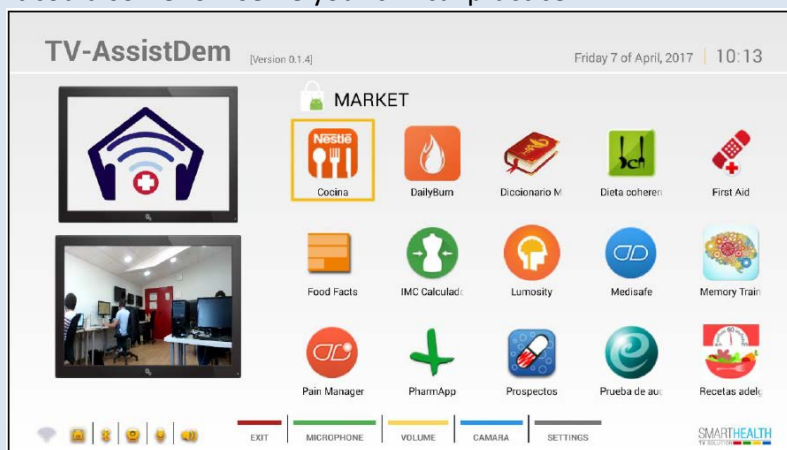
 |
| Questions |
| Is there something that could be useful for this specific type of persons?
PROBES →
  o Consider what could be useful in the patient's day life, is there something that could be |

important to be included'
- o Do you think that there should be a limit on the amount of services provided? Possible information overload could occur for this type of patient…

Thinking about your clinical practice, are there any therapy, training, etc. which could be delivered through TV-A?
- o Depending on what emerged, investigate how they would like to deliver the service, and how they would like to interact through TV-A.

PROBES →
For example, the cognitive training: some exercises could be delivered through the platform, are they supposed to be scheduled or voluntary? Do doctors want a feedback on the performance? How? A simple periodic report on performance or some kind of alerts when some abnormal score appears? What about the feedback to the patient?)

GENERAL ABOUT THE INTERACTION → The remote controller. Show it, let the participants to use it
Questions

what about the use of remote controller for interacting with the platform?
PROBES →
- o Do you think that it could be the proper way?
- o Do you consider it as easy to use, or do you think that possible motor impairments could affect the use of it?

What about other type of interaction modalities?
PROBES →
- o For example, voice interaction, gestures (there are different type of remote controllers that act through accelerometers, like the wii remote controller), or multimodal interaction… Investigate this aspect, what could be better for MD patients?

6.2   Patients and caregivers

Discussion guide, patients and informal caregivers
(please, remember to audio/video record the meeting and, if possible, to take some photos)

NOTE: Keep in mind that the focus group has a twofold goal: 1) investigating additional services tailored for mild dementia management; 2) gathering feedback for the redesign of the interface in order to make it accessible to the users with mild dementia.
Try to get a feedback on the level of importance about the information retrieved, this will be important to give priority to the requirements.

Start with a short description of the project

Aim of TV-AssistDem is to develop a technological tool to facilitate remote support to patients affected by mild dementia, exploiting TV-based transmission of data and video-interactivity between health-professionals, patients, caregivers and family members.

A key point of the project is the utilization of relatively simple technological solutions which the users are already familiar with, to minimize the learning curve impact on the daily life of the elderly who still lives at home". Indeed, the project envisages the utilization of tools accessible to pre-digital divide people, through the creation of a dedicated digital TV channel capable of supporting: (a) an interactive videoconference service with health professionals; (b) a flexible agenda and reminder system so as to foster therapeutic adherence; (c) ordinary telecare through remote transmission of vital signs data (e.g. blood pressure) and regular monitoring of cognitive functions; (d) social connectedness of patients with their families, to community organizations and to social services. In addition, the system aims at promoting a healthy lifestyle of people living with dementia at home, through counseling, exercise training by videos and online practice sessions.

Continue with explanation on what we expect from participants during this meeting
During this meeting I will show you a tool which already exists. And we will explore it step by step in the attempt to design together the better way to enhance it in order to meet your specific needs.
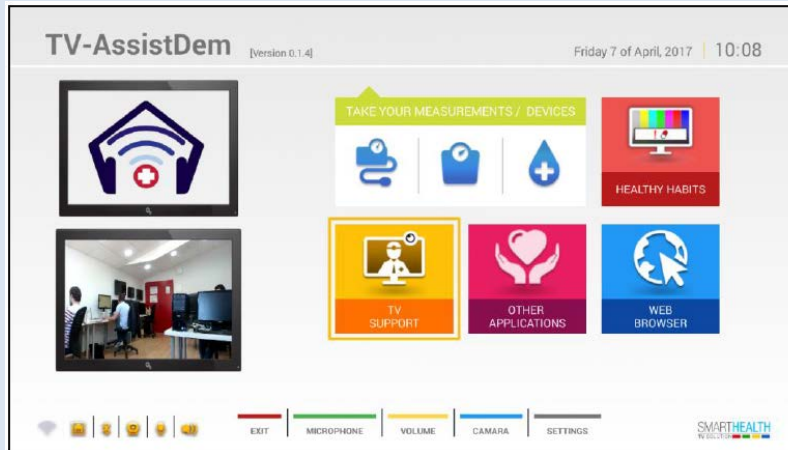
It is important for us to get insights from your point of view point of view in order to understand how to exploit this tool serving your own needs according your preferences. The ultimate goal is to design a tool that could help you in your daily life, in facing any type of concerns that could arise because of possible issues like mild memory impairments, or difficulties in the daily routine management.

Let us start by exploring a tool, with its basic functions, and let us discuss about it together in the attempt to elicit any type of suggestion to help the developers in enhancing its functions.

Participants:

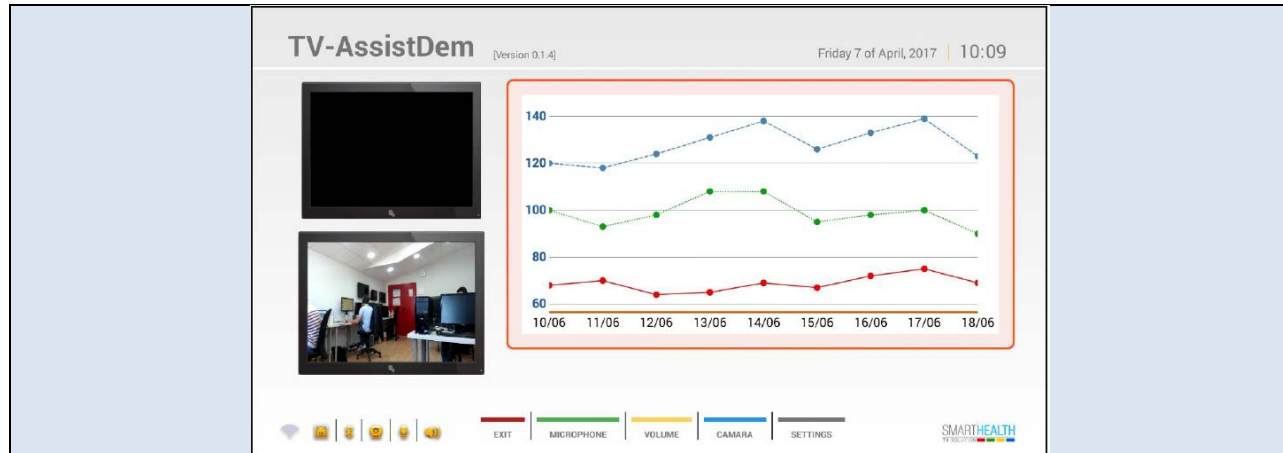| |
|---|
| HOME SCREEN |
| → show the home screen, provide a brief description and start with general considerations. |
| Questions |
| First impressions after the presentation of the project, what do the participants think? PROBES →
 ○ Generally about the idea → support through TV, potential for improving your daily life, etc.
 ○ Generally about the graphic interface → Considering your specific situation, do you think that some particular rules should be follow in building the layout? What about your preferences? Colors, font size, information organization, etc. |
| **SERVICES ALREADY EXISTENT ON THE PLATFORM** |
| VITAL SIGNS
 → show demo for blood pressure detection (pay attention so that the video does not stop, you have to turn off the sound)
 ○ It is only possible to show the history of measurements (diary) |
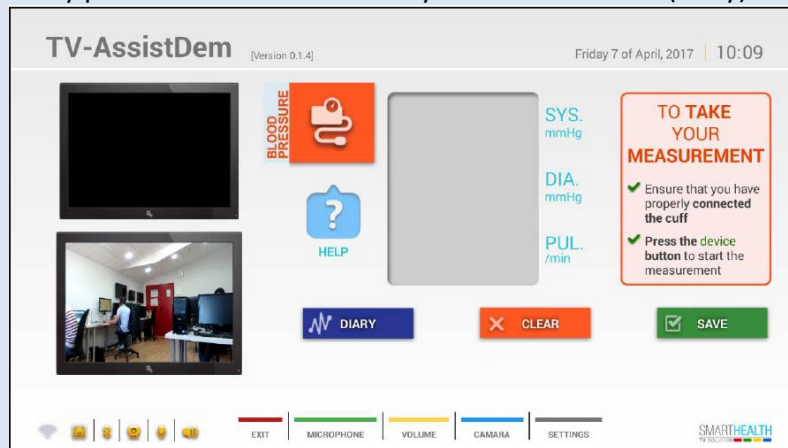
Questions

This is a function that should help you monitoring your health status. We showed you the case of blood pressure measurement, but other instruments could be integrated.

What about the graphical interface?
PROBES →

- o Any suggestion for improvements according with yours needs? What about colors, font size, information displayed on the screen, etc.
- o Is it the information displayed in a clear manner? If not, how would you prefer to get this information?

Would the care givers like to get this information as well?
PROBES →

- o Through which channel? E-mail, sms, etc.
- o In which form? Graphs, tables, etc.
- o When? Weekly, monthly, etc.
- o And what about the possibility to get alerts when some abnormal value is detected?
- o The "help" button. Which type of help do you think it would be the most useful? Technical information? General information about the measurement, etc.

HEALTHY HABITS (REMINDER)
→ show demo (the reminder appears when the right/left arrow on the remote controller is pushed. Push more than once to show both medications and appointments reminder) some reminder can be sent while the person watches the tv.

Questions

What do you think about this service?
PROBES →
   o Do you think that the pop-out can work properly? Do you suggest any other way? Sounds, freezing the tv show when a reminder appears, etc.
   o Do you think that a check on taken medication should be needed? Through which form? i.e. the pop-out disappear only after the patient takes the pills and confirm it

From your side, as a caregiver, do you need any kind of confirmation?

PROBES →

- o For example, a confirmation that a pill has been taken, or that a reminder for appointment has been checked.
- o Alerts when pills are not taken, or for missed appointments, etc.
- o What about periodical report on the old person habits, instead of punctual alerts?
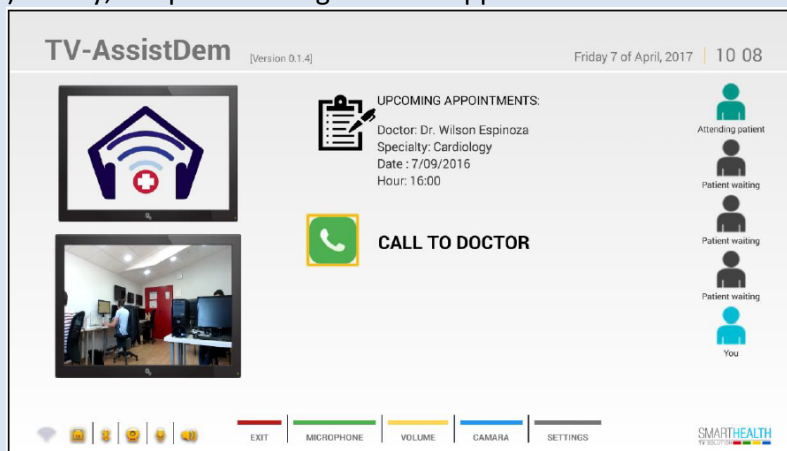
By now appointments/reminder can be set by other people (the doctors) but the patient. What about this?

PROBES →

- o Other people should be able to do it? Who? With regard to which type of reminder?
- o Do you think that it could be useful to provide the possibility for the patient to set himself some reminder? Which could be the best way? Message recording, typing a text, etc.

TV SUPPORT (VIDEO CONFERENCE WITH THE DOCTOR).
(Enter this section) Ideally, the patient can get virtual appointments with the doctor.

Questions

What do you think about this service?

PROBES →

- o The possibility to get virtual visits to your doctor would provide added value to your practice?
- o What about the information displayed? Do you think it is easy to understand?
- o Do you have any suggestion for an improvement of this service according to your specific needs?
- o What about the possibility to get videoconference with other people beside the doctor? Who?

OTHER APPLICATIONS
→ other services can be delivered through this tool according to the specific need for MD patients.
A tool like TV-AssistDem could be useful as support for the management of your daily life and it could possibly represent an instrument to overcome with some difficulties. Think about which difficulties you deal with every day that could be smoothed through TV-AssistDem.
(I would not show any image when investigating for additional applications. I found this specific screenshot pretty confounding, too much information on it)

Questions

Is there something that could be useful for you?
Think about your daily life, the most common difficulties that you face every day and that could possibly be faced through TV-A.
(maybe with older people could be useful to mention the application present in TV-A in order to provide them with some cues)
 	
PROBES →
    o Among the applications that you can see now, can you identify someone that could be useful for you?
    o What about the visualization? Do you find easy to recognize the different applications? Or is it too much confusing in your opinion?

GENERAL ABOUT THE INTERACTION → The remote controller. Show it, let the participants use it
Questions

What about the use of remote controller for interacting with the platform?
PROBES →
           o Do you think that it could be the proper way?
           o Do you consider it as easy to use, or do you think that possible motor impairments could affect the use of it?
 	
What about other type of interaction modalities?
PROBES →
    o For example, voice interaction, gestures (there are different type of remote controllers that act through accelerometers, like the wii remote controller), or multimodal interaction… Investigate this aspect, what could be better for MD patients?