



PersonAAL



Deliverable 2.3

Health workers requirements analysis

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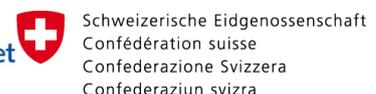
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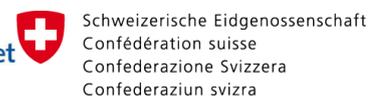
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EXECUTIVE SUMMARY

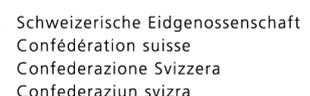
In Europe, as in other developed countries, there is an increasing number of elderly people. While this demographic trend is generally regarded as a positive signal of improved living conditions, at the same time there is the need of providing adequate support to such increasing number of ageing people in order to cope with the increased risk of developing health diseases in later life. In addition, increased life expectancy combined with declining birth rates have caused many to worry about the cost and sustainability of supporting this growing ageing population in the next future. In this scenario, the main goal of PersonAAL is extending the time older people can live in their home environment by increasing their autonomy and assisting them in carrying out activities of daily living by means of intelligent and intuitive web applications enabling users to receive personalized and context-dependent assistance directly in their own homes with the goal to improve quality of life and decrease healthcare delivery cost. The technological platform developed in the project will support controlling/monitoring daily elderly activities by exploiting a number of different sensors, devices and modalities. One of the innovations of our technological platform will be the fact that it will be capable of providing interactive and proactive solutions anticipating elderly needs, and dynamically adapting/accommodating individual user requirements to changes in different contexts of use. Moreover, we also aim to provide caregivers with intuitive tools through which they will be able to easily customise interactive services to the various needs, requirements, tasks and contexts of the elderly. The design of all these services and applications needs to be guided by the knowledge, needs and expectations of the different stakeholders. The deliverable reports the requirements gathering activities focused on the formal caretakers conducted during the first six months of the project.

During this period, we were looking for a rich and detailed representation of what are the current practices employed by health professionals and therapists, in the scope of organized social services, as well as their opinion about limitations and future expectations. To this end, we organized and conducted two focus groups in Oslo with health care professionals. The results of the focus groups were analysed and consolidated into a hierarchical list, grouping them into the four main categories: current practices, limitations, expectations and concerns.

The findings so far have identified a series of topics that need to be supported by the project to ensure its adoption. PersonAAL should take sensing and monitoring to the next level, by endowing it with activity detection mechanisms. To ensure that preventive measures are more effective, PersonAAL should include persuasion mechanisms. Sensing, activity detection and persuasion should be uptake at the individual scale, thus promoting a truly personalised solution. To improve upon existing solutions, PersonAAL needs to include mechanisms that are sensitive to fine changes and able to detect the early onset of symptoms. Health professionals wish for better than existing support in what concerns detecting and managing senior's cognitive decline. PersonAAL's base mechanisms should be able to contribute to the development of solutions in this field. Finally, the project needs to develop solutions that address privacy concerns, and to design sensors and wearable devices that blend in with older adults and their living environment.

In the final version of this deliverable we added the results of a second workshop with formal caretakers that was driven by a prototype of one of the PersonAAL's applications.

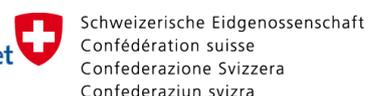
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1 INTRODUCTION

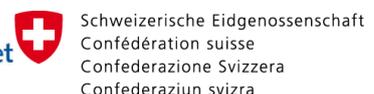
The PersonAAL project aims at extending the time older people can live in their home environment by increasing their autonomy and assisting them in carrying out activities of daily living by means of intelligent and intuitive web applications. This will enable users to receive personalized and context-dependent assistance directly in their own homes with the goal to improve quality of life and decrease healthcare delivery cost. In particular, the aim of this project is to provide older adults with useful and usable means for better managing their lifestyle. Such means should allow them to increase their awareness and control of their current lifestyle. This will be done through the development of novel solutions for accessible and context-dependent personalized web applications and the improvement of remote formal and informal care of the elderly.

PersonAAL also wants to enhance the relationship of older adults with informal and formal caregivers, by providing customisable environments able to support the elderly more effectively. To this regard, the project will also develop an environment through which it will be possible for the caregivers to easily and intuitively configure and manage a number of adaptation rules aimed at offering personalized and intuitive services to the elderly in various environments and contexts. Since only caregivers have a deep knowledge of the older adults' needs or preferences, it is important to offer them customisable environments through which they can appropriately tailor not only the support provided to the elderly but also the support (notifications, reminders, communication/coordination tasks with other caregivers, etc.) provided to themselves.

To achieve these goals, the technological platform developed in the project will support controlling/monitoring daily elderly activities by exploiting a number of different sensors, devices and modalities. Moreover, we also aim to provide caregivers with intuitive tools through which they will be able to easily customise interactive services to the various needs, requirements, tasks and contexts of the elderly. The design of all these services and applications needs to be guided by the knowledge, needs and expectations of the different stakeholders: seniors, informal caretakers and formal caretakers. This deliverable reports the conducted requirements gathering activities focused on the **formal caretakers**. Requirement gathering activities focused on older adults and informal caretakers are reported in D2.1 and D2.2, respectively.

This report is organized as follows: Section 2 briefly summarizes information regarding health care services and policies, as well as e-health policies in place in Norway and Switzerland. This information is presented in more detail in deliverables D2.1 and D2.2. Also in section 2, we present a brief discussion on technology adoption by health care professionals. Section 3 presents the objectives of the research activities conducted with the focus presented above in this period, clearly stating the research questions addressed. Section 4 describes the methodology put in place, and discusses its limitations. Section 5 reports the results collected in two focus groups conducted in Norway. Section 6 analysis the findings and discusses their implications for the future design decisions of this project. Finally, section 7 presents conclusions.

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2 STATUS QUO

Health care services are tasked with the maintenance and improvement of health through diagnosis, treatment and prevention. Health workers are the individuals who contribute by providing preventive, curative or rehabilitation services. In the context of PersonAAL, we are especially interested in services related to elderly care, and the possibility of using electronic means to support care provision. We also started by focusing our information collecting activities in the sites of the two expected pilots: Norway and Switzerland.

2.1 Health Care Services and Policies

In Norway, public health services are free of charge. Long-term health and care services are usually covered by the public health services. The local authorities or municipalities are the organizations responsible for providing these services, including the ones delivered at the home of the patient.

In Switzerland medical services are usually carried by private organizations, but the public sector is obliged to take on these responsibilities when no capabilities can be allocated to the patient. Care services are offered in nursing homes, but can also take place in the patients' homes.

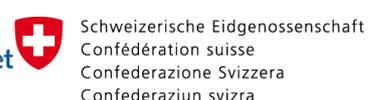
In both Norway and Switzerland there are still no official e-health policies. However, in both countries two official bodies are working on establishing national policies. In Switzerland this effort is more challenging given the administrative nature of the country. Telemedicine services exist on both countries. Obligations for health professionals are independent of whether the consultation is remote or in place. Additionally, data protection and electronic security measures need to be followed. More details on the care services, and the role of health professionals, in both countries, as well as on their e-health efforts can be found in section 2.2 of deliverable D2.1 and section 3.1 of deliverable D2.2, which, although being focused on the older adults and informal caretakers, respectively, also cover the perspectives of formal caretakers.

While the attitudes and behaviours of seniors towards technology are reported in D2.1, in the following paragraphs we report on specific aspects regarding technology adoption from the perspective of health professionals.

2.2 Technology Adoption

Presently, ordinary phones and computer-based electronic medical records (EMR) are the most commonly used technology among health care professionals. In Norway, health care workers have limited opportunity to communicate with patients through e-mail communication due to data protection and patient privacy legislations. Telemedicine video communication is available in some hospitals, but typically these systems need to be deployed in secure networks which most patients do not have access to. Many health care professionals have knowledge and skills about more advanced e-communication (chats, sms, mms and video communication like Skype

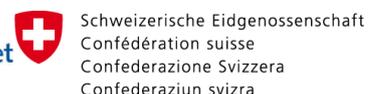
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and Facetime) than they are allowed to use when communicating with their patients. Synchronous or live communication (like phone calls and video conferences) is only possible if the health care worker is available at the same time as the patients. New communication technology based on live communication would experience the same challenges as telephone communication has today, i.e., it might be hard to find time when both parties are not occupied. Asynchronous communication technology might be easier to integrate in a hectic workday. Most health care professionals, both in inpatient and outpatient units, have a busy schedule that does not allow them to answer calls from patients when they are made. Asynchronous communication solutions would enable health care workers to respond when they have time. Of course, emergency calls and alarms are an exception from this, but they are handled by well-staffed call centres. The disadvantages of asynchronous communication are that the patients will not get an immediate response to their request, and that answering to messages from patients may take a long time. Mobile equipment like tablets and smartphones may enable swifter responses since health workers can bring the equipment with them and use short breaks between other tasks to respond to patients enquires.

Health information is currently stored and operated in secure systems that do not exchange information easily with others systems. For example, e-communication with patients cannot be stored automatically in their Electronic Medical Record (EMR). A solution like PersonAAL would need to operate outside of the major EMRs, which are in use in Europe today. In order to do this, the solution will need to comply with the present security standards for handling digitalized health information.

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3 OBJECTIVES

3.1 Scope

The PersonAAL project aims at delivering mechanisms to enable the development of solutions that could contribute to extend the time older adults can live independently in their own homes. These solutions would lead to an increased autonomy of the elderly, supported on increased assistance in their daily living activities, but also on facilitating care provision by formal and informal caregivers.

PersonAAL's work package 2 deals with requirements gathering activities. In particular, one of its goals is to collect, organize and relate requirements from all the classes of users that will interact with the applications and services supported in the project. One of the classes of users are formal caretakers. These include different categories of health professionals that are in charge of diagnosing, planning, delivering and assessing care plans for the target elderly group. In the scope of task T2.2, which focuses on the elicitation of requirements focused on care givers, we identify the need of investigating the requirements of clinical staff regarding care provision activities. Specifically, we want to understand their information needs and information exchange requirements, both current and when presented with the possibility of having remote monitoring and remote assistance services available.

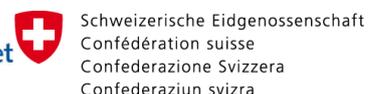
The requirements gathered as parts of these research activities are focused on the formal caretakers. It is expected that the information collected will also afford requirements relevant for informal caretakers and the elderly. Consequently, while this deliverable is focused on the needs and expectations of health professionals, it should be considered in the larger scope of requirements gathered in D2.1 and D2.2, which present requirements focused on the elderly and informal caretakers, respectively.

The requirements presented here are relative to the work conducted during the first six months of the project, and are not intended to be the final requirements. A revised version of this report, including a validation of the requirements presented in this version, will be delivered in month 18.

3.2 Problem Statement

As part of work package 2, and task T2.2 in particular, we have planned requirements gathering activities focusing on health professionals. In particular, we want to investigate the requirements of clinical staff and other formal care providers, if faced with a service model that moves the primary care delivery to the patients' homes. In this context, we wish to understand what are the information needs of health professionals to supervise remote care activities and what information exchange with older adults and informal caretakers is needed.

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3.3 Goals of the deliverable

The deliverable aims to report the research work conducted to elicit data about the limitations and expectations of health care professionals. Additionally, the deliverable aims to present a discussion on the implications that the findings have on the feasibility of the project and on the design choices that will have to be made in the future months.

3.4 Research Questions

Healthcare professionals not only play the driving role in healthcare provision, but are also the ones responsible for deciding what measures the beneficiaries of health and social systems need. This gives them a unique perspective of the healthcare system. Whereas individual senior beneficiaries, or informal caretakers usually have a perspective based on their own case, health workers are exposed to a multitude of individuals, which enables them to have an extended vision of the workings and limitations of the healthcare provision services. With this research work, we wanted to tap into this knowledge, and characterize how care services are currently provided, what challenges are faced, and how they can be improved. To this end, we listed the following research questions.

How are care services currently provided?

With this question we want to characterize current care services provision. In particular, we want to understand who are the key stakeholders, where is care provided and what types of intervention are common.

How are elderly in need of care assessed, and how is their evolution tracked?

This research question looks with more detail into one of the most important aspects of care provision: deciding when someone is in need of care, and how to keep track of that person's evolution. We wanted to understand what is the workflow and what types of tools are used to this end.

How can technology contribute to the improvement of care services?

With this question we want to investigate what technology is already deployed and used in the domain of care provision systems. In particular, we wanted to learn about technology that can be deployed in the seniors' homes.

What factors can contribute to the adoption of a system like the one proposed in PersonAAL, by health workers?

This research question tries to identify the driving factors that can contribute to the future adoption by health professionals of a system with the characteristics envisioned in PersonAAL.

What factors can contribute to the adoption of a system like the one proposed in PersonAAL, by older adults?

This is a similar question to the previous one, but now focused on the older adults, from the perspective of health workers.

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4 METHOD

We were looking for a rich and detailed representation of what are the current practices employed by health professionals and therapists, in the scope of organized social services, as well as these professionals' opinion on their limitations and expectations created by future technological solutions. To this end, we opted for a qualitative approach.

4.1 Initial Focus Group – Oslo – November 2015

4.1.1 Target Group Specification

For the stated objectives, we needed to consider two main information sources: health professionals, including medical doctors and therapists; and representatives of healthcare providers.

4.1.2 Method and Procedure

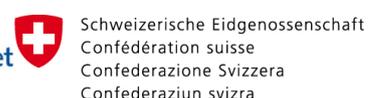
We organized and conducted two focus groups in Oslo. The first focus group took place on November 24, 2015 in the facilities of Sunnas Rehabilitation Hospital. Besides PersonAAL members, a medical doctor and a rehabilitation therapist were also present. The second focus group took place on November 25, 2015 in the same venue. Three physical therapists, one occupational therapist, a manager of a resource centre for geriatric services and a representative of the Oslo centre of development of home-care services attended this focus group. Each focus group lasted for about four hours. Both focus groups followed the same approximate procedure. The context and overall goals of the project were first introduced. We then discussed how, currently, older adults receive care and support from the municipality services. Finally, we debated how some of the concepts PersonAAL wishes to introduce could be adopted and improve current practices. In particular we considered monitoring capabilities, personalization features, persuasive mechanisms and end-user development procedures.

Both focus groups audio was recorded. Later, this audio was transcribed. Two researchers reviewed independently the resulting documents. In the revision, they applied emergent coding techniques, compiling a list of approximately 200 codes. These codes were reviewed and consolidated into a hierarchical list with four levels. The highest level organized the codes into four main groups: **current practices, limitations, expectations** and **concerns**. Afterwards, two other researchers coded independently the focus groups transcriptions, based on the initial code list. This led to a revised code list that served as an aggregator for the findings.

4.1.3 Limitations of the Study

The conducted study has one major limitation. The study's scope is narrowly centred in the Norwegian reality, as only Norwegian health professionals participated in the focus groups. Even if a number of those professionals had international experience, the discussion was focused in the Norwegian reality. To address this limitation, we plan future activities to validate the findings from this study in other countries, in particular in Switzerland. These activities will consider also qualitative data gathering, probably interviews and enquiries, with health

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professionals in these countries. Additionally, we want to validate the findings that do not relate specifically to the health professionals, that is, the findings with impact on the other stakeholders (elderly and their formal caretakers), with representatives of these stakeholders in Norway, Switzerland, and possibly Italy and Portugal.

Another limitation of this study is the small number of participants in the two focus group sessions (eight participants in total). Nevertheless, the focus groups allowed capturing rich and varied information regarding the different activities conducted by these professionals and will be shown in the next sections. The mitigation measures identified in the previous paragraph also contribute to address this limitation.

4.2 Final Focus Group – Oslo – March 2017

4.2.1 Target Group Specification

Similarly to the initial focus group, we considered two main information sources: health professionals, including medical doctors and therapists; and representatives of healthcare providers.

4.2.2 Method and Procedure

The aim of the focus-group interview was to get feedback on the prototype of the application "Remote Assistant". For this deliverable, the interview focused on what the participants considered to be of use in an application designed to be a remote assistant for elderly people to be able to live home for as long as possible.

Seven health-care workers with extensive experience from rehabilitation medicine, including follow-up services, participated in the focus group. The focus groups was recorded, transcribed and later analysed by one of the project's researchers. A qualitative data analysis process was followed, leading to the identification of the major topics discussed in the following chapter.

4.2.3 Limitations of the Study

The study's scope is centred in the Norwegian reality, as only Norwegian health professionals participated in the focus groups.

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5 FINDINGS

This section presents the findings from each of the research activities conducted.

5.1 Initial Focus Group - Oslo

In this section we detail the findings, organized according to the result of the aforementioned coding procedure. For each of the four main groups, we discuss the identified themes. Representative quotes from the focus groups are also provided in brackets. Annex 1 presents in detail the list of codes that resulted from the coding procedure, with the entire grouping levels identified, and an indication of the degree of importance of each code for the project.

5.1.1 Current Practices

5.1.1.1 Caretaking Location

Caretaking activities take place over a diverse set of locations. In what concerns PersonAAL, the older adults' **homes** are the main locations for caretaking ("*nurses mostly go physically into the home*"). Other places include elderly homes, nursing homes, rehabilitation centres, municipality centres and hospitals. It should also be highlighted that **remote caretaking** was also mentioned (*they can do it by phone*), which is also important for this project.

5.1.1.2 Frequency of Caretaking Activities

Identified caretaking activities can take place over a wide range of frequencies and periods. Some activities take place just once. Others might occur on a weekly basis, or multiple times per week ("*you have nurses coming regularly few times a week*"). Other activities occur daily, or even multiple times per day ("*People that really need to sit with the healthcare personal four times a day as a conversation arena*").

5.1.1.3 Patient Conditions

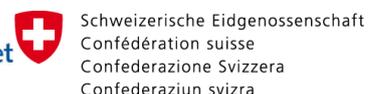
A wide range of conditions afflicting the patients that benefit from caretaking services was found. These include: chronic patients, dementia, heart disease, lung disease, mental illness, strokes, orthopaedic issues, limited mobility and loneliness. Several of these conditions do not prevent the older adult from living in their homes, thus are representative of illnesses that might affect PersonAAL's primary group.

5.1.1.4 Outcomes

Current desired outcomes of caretaking practices are governed by two major factors: **economic** savings for the health care and social systems ("*is not really a cheap way of solving this problem because the less the person can do the more society has to do*"); **behavioural** changes reflected on the elderly's lifestyle.

5.1.1.5 Caretaking Activities

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The reported caretaking activities were analysed according to four themes: who and why triggers a request for caretaking; how are those requests and the condition of the elderly assessed; what kind of interventions take place; and what technology is used in this process.

All the groups considered in PersonAAL can **trigger** requests for caretaking: formal caretakers (GP, physician, therapist), informal caretakers (family, friends, neighbours) or the elderly themselves. Reasons for triggering the requests are also varied: insufficient assistance being provided, the appearance of new symptoms, specific episodes (*"A lot of people that had fell is afraid of having an injury or a fracture and they will go to some kind of care"*), need for emergent care or the detection of changing habits (*"Another way of doing it is [...] when elderly change their habits"*).

Assessment is conducted either by request, or when the older adult is already being cared for. Both GP and Nurses are responsible for assessing the elderly's condition. Assessment **measures** include long and short-term memory performance, activities of daily living (*"We have to measure what we are trying to change. So we need to find out what do you want to change? [...] Isn't it physical functioning or the ADL? The ADL, yes!"*), social communication, ability to remember to take medicine, eating routines, cleanliness (*those who have problems cleaning their houses*) and messiness.

Several **tools** are used for helping the assessing procedure. We identified the following ones: iPlos¹ (Norwegian system for registering information about patients, including their assessment), letter of care, enquiries, observation (*"when it comes more to aging related declines is more observations and kind of like clinical eye"*) and MMSE (mini-mental state examination).

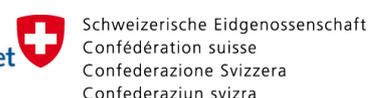
The **outcomes** of the assessment procedures support the definition of a diagnosis, as well as the type, amount and duration of required interventions.

Interventions are usually of rehabilitation nature, although various types of support actions are also common (e.g. elderly that are no longer able to perform one activity of daily living alone receive help from caretakers). Formal caretakers are supported by a task list, identifying the required tasks for each older adult. They perform regular assessments of the elderly's state and report those.

In the Oslo municipality context we found that **technology** is already being explored in the context of caretaking support. Phones and smartphones are used as a means to ensure communication. Other examples of technologies deployed in the field are: fall detectors, alarms (e.g. safety, fire), motion sensors, medicine dispensers, wearable bracelets, necklaces to signal events and other technologies available in smart houses. However, it should be noted that some of the mentioned technologies are only used in the context of special municipality sponsored projects.

¹ <https://helsedirektoratet.no/iplos-registeret>

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5.1.2 Limitations

5.1.2.1 Paradigm

The current paradigm in the healthcare and social systems is **compensatory** (*"today most of the services are compensatory"*). This means that care services are called into action only after a need has already been identified, and care is geared towards rehabilitation of existing conditions or support of activities that can no longer be performed by the senior. It was unanimous from the participating medical doctors and therapists that resources would be more efficiently used if, at least to some extent, they were directed to preventive efforts.

5.1.2.2 Assessment

As previously mentioned, nurses usually assess the condition of the older adult as part of caretaking activities. However, it was clear from focus groups participants that these assessments are mostly **useless**, because there is no follow-up by medical doctors, unless some drastic changes are reported (*"in my professional perspective then it's already a little late"*).

Another set of limitations arises from the individual and personal nature of the assessments. This is reflected by different assessments being made by **different people** under the same circumstances (*an occupational therapist might look for some other things than a physical therapist*), and that, sometimes, the person doing the assessment departs from **wrong assumptions** about the situation of the senior being assessed (*"focus here is to make sure they don't have a fracture and if they don't have a fracture there is nothing to do. But there is definitely something to do"*).

Finally, one important evaluation, that is usually not made, at least in a comparable manner, is a **cognitive evaluation** of the older adult (*"The really main issue is the deterioration of the cognitive ability and how to pick up that"*).

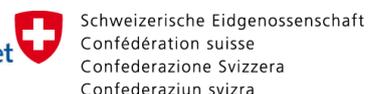
5.1.2.3 Systems

Existing care systems have not been positively described by the participants in the focus groups. They have been characterized as **rigid** (*"Can I comment on the iPlos, the Norwegian iPlos? [...] my opinion about it is that it's not very dynamic. It's very rigid"*), by failing to change based on the context of the senior; **narrow**, because they cannot accommodate new information that might become available; **slow**, because assessments take too long to signal changes of the elderly; and **general**, because they prescribe the same solutions independently of specific characteristics of the individuals being cared for (*"But it doesn't differentiate if you come to this room, if you sit in the wheelchair or if you do it by yourself"*).

5.1.2.4 Challenges

Various challenges that might limit the applicability and effectiveness of care solution have been identified in the focus groups. These could be grouped by stakeholder: the individual being cared for, and the formal caretaker.

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In what concerns the seniors, a major challenge is being able to collect in time the appropriate data to **characterize users** (*"One of the biggest challenges in designing this kind of systems is exactly getting that knowledge of who are the users"*). Additionally, it is common that the older adults that are in greater need of caretaking are the ones that are harder to **reach**, often because no one is available to trigger the required caretakers (*"if you are going there, you have to come there by yourself"*). For this we need systems with enough **sensitivity** (*to be able to reach those in need*), and **specificity** (*to separate the ones that have a true problem for those that do not*). Traditionally, older adults' conditions evolve slowly. This means that assessment and monitoring systems need to be able to detect **minor changes** to be effective (*"That depends of what the deterioration is, is it a kind of small happening? They won't report it!"*). They also must be able to react quickly, supporting **early catching** of new symptoms or habit changes (*"It can be hard in the starting phase to detect if it's a depression or a cognitive decline"*). These solutions must be designed in a way that overcomes the **unwillingness** that this population might show towards its adoption (*"But that's the point, you have to go there by yourself. So if you are 65 and you are in that danger zone of getting a decline probably you won't go there"*). This means that it is fundamental that the systems make it easy for their future adopters to **perceive the benefits** of using them (*"That will have to be perceived in the mapping and before you introduce the technology that this is something I want. I perceive it as beneficial, or else it won't work basically"*). Additionally, this population is usually characterized by a **lack of initiative** (*"But you have to detect those people, because they are usually losing their initiative, and they think "I don't bother that program, I won't go there"")* and the real possibility that they lack the **ability to follow instructions** (*"They are reminded but they ignore it and five minutes later they have forgotten."*).

Regarding the formal caretakers, several challenges were also identified. Available resources were criticized. In particular, **lack of healthcare professionals**, **lack of informal caretakers** and **lack of nursing homes**, were mentioned. This leads to problems with the **load balance** of caretakers. Finally, one challenge that was also raised is that some of the technology available to caretakers is too **specialized**, making it hard to use.

5.1.3 Expectations

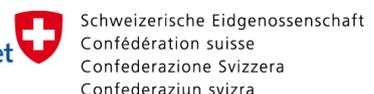
5.1.3.1 Paradigm

As expected, after knowing the reported limitations, the desired paradigm is a **prevention** based one (*"If we could start some years before the decline and how to prevent the decline"*). As aforementioned, healthcare professionals recommend the caretaking system to follow an approach where caretaking activities are directed to promote and support healthier lifestyles that could delay the need to rehabilitation and other compensatory mechanisms.

Another suggestion is for an holistic caretaking system, where **capable elderly are providers** of care themselves (*"Something where the patient take actively part in both decision making but in their own health."*). This would improve their self-esteem and contribute to an overall improvement of their conditions, while fighting the already mentioned lack of informal caretakers.

5.1.3.2 Systems

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Once more, the expected characteristics of care supporting systems are opposite of their existing characteristics. Systems should be **adaptable**, so that they can benefit from the knowledge about specific individuals to change their user interfaces of features offered (*"the system must have a way of evolving, and changing and expanding"*). They should be **sensitive**, so they can quickly perceive small changes. They should **blend in** with the elderly and environment (*"I need something to blend in to my environment"*). This requirement is fundamental to increase their hypothesis of adoption, since seniors don't want to wear something that exposes their need of assistance. The ability to **personalize** applications to the specific needs or characteristics of individual seniors was also identified as a desirable characteristic (*"I mean some people think that like fitness and training gives their life meaning, and some don't. Right? So we have to individualize it anyway"*). Finally, if the system could incorporate **persuasion** mechanisms, the healthcare professionals agree that it would promote healthier behaviours in accordance to a preventive paradigm, or might improve the efficacy of rehabilitation measures (*"would remind the patient of the medication that he needs to take and ideally would also monitor if the medication was really taken"*).

5.1.3.3 Outcomes

The identified desirable outcomes are well aligned with the characteristics of the systems presented above. Solutions should support **early detection** of symptoms (*"catch some of the people sooner. Before they are in need of home-care services. Before they are need of someone coming in to assist them. Before they are in the hospital with a serious condition"*), support **cognitive evaluation** (*"a dream like situation would be that we could with the use of computer programs kind of have an assessment of the elderly to pick the cognitive deterioration"*) and **cognitive rehabilitation** (*"Like a rehabilitation option for cognitively declined people that's one of the tools"*), promote **social activity** and **physical activity** and support **functional rehabilitation** (*"The idea would be to have some kind of application that would support rehabilitation activities be it cognitive, be it physical that tries to make it better than what you already have"*). Another important characteristic for a technologically supported solution is the ability to ensure the **connectedness** between all stakeholders and being able to **accommodate different perspectives**. Overall, all these should lead to a solution that allows elderly to **live independently** for longer, **saving time and money**.

5.1.3.4 Technology

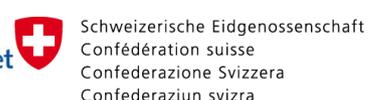
Another outcome of the focus groups were suggestions of technologies that could be part of an ecosystem leading to the presented desired outcomes. Discussed technologies included: **sensors, health bands, voice synthesis, tablets, computer applications** and **tele-care** solutions.

5.1.3.5 Features

The focus groups participants also suggested several features, of different domains, that would be useful to consider. In what concerns modelling of user characteristics, the **ICF model**² was suggested as a more flexible approach when compared to current models, like the iPlos (*"So I would prefer to use the ICF module, I think the module with all it's domains it's better to*

² <http://www.who.int/classifications/icf/en/>

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understand"). Suggested features to be part of a future solution include: support for **reminders** ("I was thinking that probably we should develop some voice reminders."), **collaboration** and **family mediated communication** between the senior and the formal caretaker ("we have to collaborate with their family"). For the health worker, the ability to **filter data** by their needs was deemed important ("I don't necessary need all the data collected"), as well as the possibility to **remotely access** the system to change settings, for instance.

One important issue raised, is the need to incorporate physical and cognitive dimensions in the activities promoted, following recent research on **dual task** [Howcroft et al., 2016] [Pichierri et al., 2012] ("it's very important to practice balance with the dual task challenge"). Another suggested approach, which could be combined with dual task, was **gamification** [Daniele & Ascolese, 2015] [McCallum, 2012] ("they have environment there for game techniques used with elderly people"). Finally, health professionals suggested the system could have new features added on a regular basis so it would keep **interest** levels high for longer periods ("If you want more features you are invited to add features and it stays alive and stays interesting").

5.1.4 Concerns

5.1.4.1 System

Participants in focus groups have identified the need to have solutions that are adaptable and personalizable. However, they recognize that the great **variability** in individual characteristics and needs make this a challenging outcome ("You have to have a system with a lot of variability in it in order to capture everybody"). The large number of discussed solutions also raised questions about the feasibility of reaching a solution that would be able to integrate the different features, leading to **failed expectations**.

5.1.4.2 Stigmatization

One important concern raised relates to the stigmatization that the **appearance** of physical components of a system of the characteristics of PersonAAL's could have ("might be a lot to put you off introducing it, as it might be perceived as stigmatizing. So I don't really want to show that I need help"). It is important that the appearance of these components do not betray the needs of its users in order for it to be adopted by them.

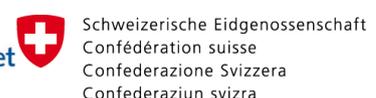
5.1.4.3 Approach

Medical doctors and therapists agreed that solutions that aim at **keeping people safe** could produce wrong outcomes ("Because there is a lot of systems put into place for older people with the assumption they need to be monitored or they need to be safe"). Instead solutions should promote social and physical activity instead of limiting movements or contacts.

Other kind of concerns that were put forward related to the eventuality of these solutions leading to a **removal of healthcare professionals**, or demand for **extra effort** ("That will probably translate into an extra effort that the caretaker needs to do").

5.1.4.4 Anxiety

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The use of technology, if incorrectly designed, can lead older adults to symptoms of anxiety, as reported by the health professionals. In particular, elderly can experience **fear** of technology if it is not introduced properly (*"People often become very full of fear"*). Other aspect that needs to be considered is the possibility of technology causing **confusion** to its users (*"it has also the potential to generate some confusion"*).

5.1.4.5 Privacy

Privacy was one of the most concerning aspects raised. **Monitoring** solutions will collect personal data that should respect data protection issues (*"If you are in a monitored in terms of someone is following you, if you are on the toilet or at home many times and [...] that is not so nice"*). Furthermore, legislation relating to this will vary across different countries, which must be considered by solutions in this domain. Also, **data ownership** ensuring mechanisms must be designed into the system (*"you gather the information as your personal information. The data is yours"*). The senior owns the collected data, and there must be mechanisms to control with whom it could be shared.

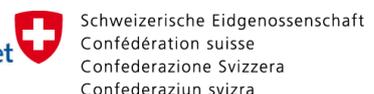
5.1.4.6 Acceptance

The final category is of extreme importance, since it identified a series of concerns that influence how elderly could accept and adopt a solution with the characteristics envisioned in PersonAAL. First, for the future users to adopt a solution they need to be able to understand its **usefulness** (*"so that themselves think "oh that would be something that would be good for me"*). To this end, its ability to promote their users' **independence** (*"prolong the time they want to live independently"*) and **security** should be explored (*"Their comment was that they felt secure"*). One way to increase the chances of adoption, by raising **awareness** to it (*"the main thing is getting to the point that people actually know about it"*), is having **role models** show its usefulness (*"you should see other people who are role models to see that they have a lot of use for it"*). These could be family, neighbours or other acquaintances that have used the system previously and can demonstrate its benefits. Other motivating factor for adoption is possible **recommendations** to use such a system from health professionals and caretakers. To address such a diverse user group, it is important that a solution could be introduced gradually, starting with features their users are already **familiar** with (*"Because that's something that is familiar"*). This will allow also exploring any **technology empathy** its users might have (*"we have a lot of patients coming there from all over the country and we see that those who were engineers and having experience you know, they are so into technology, so they are usually teaching the health personal about how to use technology"*), as well as decrease the **adoption time** required to adopt this solution (*"I have one of my friends that took 10 years before she kind of starting use it. So I think you have to give them time"*).

5.2 Final Focus Group - Oslo

In this section we detail the findings of the final focus group, organized according to the topics that emerged from the qualitative data analysis procedure.

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5.2.1 Overall Goals and Features

An application for remote monitoring older adults should be focused and usable. To promote adoption of such an application, it must clearly distinguish itself from the numerous other applications already available in Web and mobile stores. Participants in the focus group suggested potential focus areas for the application: food, news or health. One potentially distinguishing factor would be to have the application support training (in its specific domain) and being strongly linked to therapists and other caretakers so that the older adult could schedule training appointments with a therapist and report different indicators (e.g., weight) or activities performed to caretakers.

5.2.2 Distinguishing Features

From the focus group emerged several features that could separate a remote monitoring application from the existing ones:

- Transform the remote data gathered into knowledge that could be used to promote healthier lifestyles for its users, through the endorsement of good habits and routines. (persuasion)
- Incorporate advice, recommendations and other types of guidance from GP or other healthcare professionals. (rule editor)
- Provide information about local services and events that is of interest to the older adult. (personalization)
- Offer social support, through communication and collaboration features that facilitate interacting with family, friends and formal caretakers. (social)

Besides the application features, the participants also mentioned important aspects related to the interface of such an application:

- Speech interaction – important both for input and output.
- Control – it must be possible to adjust text size, contrast, light and sound levels.

5.2.3 Concerns

The focus participants also mentioned several issues that must be properly addressed to ensure a positive adoption of a remote monitoring application:

- Training – if needed, how can a user be trained to use of the system.
- Safety and privacy – since the application has the potential to collect sensitive data from its users, it is paramount that the data is kept private and that the user has control over it.
- Price – costs for acquisition and maintenance/updating of the system must be within reach of the target group.
- Anxiety – make sure that information presented does not cause insecurity, anxiety or unjustified concerns (e.g., for users that are hypochondriacs)

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Confederaziun svizra

6 ANALYSIS

In this section we analyse in more detail the results from the focus groups, in an attempt to answer our research questions and understanding how these findings impact the future of the project. It is important to stress that findings reported at this stage are mainly related to the Norwegian health care system.

6.1 Research Questions

How are care services currently provided?

Care services in the Oslo municipality are provided to everyone that is in need and requests them. Requests for care can come from the senior, a family member, friend or neighbour (informal caretakers) or general practitioners or other medical doctors (formal caretakers). After an assessment by a GP, a care plan is elaborated and put into practice. This consists in providing the support required, that could range from health care practice, to supporting activities of daily living that the senior is not able to do on his own, or other necessary measures. The care support happens with the frequency that is necessary, ranging to multiple times a day, to weekly or longer periods. Health care is traditionally provided by a nurse, or multiple nurses when needed, at the senior's home. For other non-health related interventions, other professionals are usually involved. Some interventions do not take place at home, e.g. physical rehabilitation requiring equipment that is only available at a rehabilitation centre.

How are elderly in need of care assessed, and how is their evolution tracked?

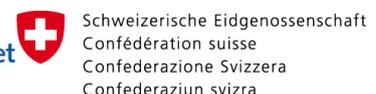
The initial assessment is performed, usually, by a GP. As a result of the diagnosis, a care plan is produced, with details of the interventions required and their frequency. The follow up is conducted by whoever is on the field providing the care assistance. We identified several tools used for assessing the senior's evolution. However, it became clear that these assessments fail to reach the GP for reassessing the care plan. This, usually, only happens when major changes are detected, that prompt a new assessment. Finer changes are only perceived after longer periods, thus decreasing the efficiency of the care system.

How can technology contribute to the improvement of care services?

We found various examples of technology that already plays a role in the care provision system. The more common is the telephone that is used for communication support and in remote care procedures. Fall detectors and different types of alarms are being increasingly used. Other type of monitoring devices, that when networked create smart environments, are starting to be deployed, mainly as part of projects conducted by the Oslo municipality. Health professionals expect technology to play an important role in this domain, in particular, several sensing mechanisms are seen as useful, especially if they can be used in form factors similar to objects already worn by the older adults (e.g. watches, necklaces and bracelets). Voice synthesis is also perceived as an important medium for communication between seniors and interactive systems.

What factors can contribute to the adoption of a system like the one proposed in PersonAAL, by health workers?

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From the perspective of health professionals, novel systems should overcome the limitations of existing ones. Specifically, systems are requested to be able to adapt to changing contexts (e.g. to evolving conditions of the senior), to be sensitive to changes in the older adult's condition, even if minor, and to be personalised so that each individual is able to receive the specific care actions that he or she requires. Overall, health professionals would welcome a solution that could facilitate a transition from a compensatory care paradigm to a prevention care paradigm.

What factors can contribute to the adoption of a system like the one proposed in PersonAAL, by older adults?

Health professionals were able to identify a series of characteristics that, in their opinion, a system like the one proposed in PersonAAL should have to be adopted by the elderly. The one that stands out the most is the ability of the system to blend in to the senior's environment. The system, or its components, should not make apparent that the beneficiary is in need of any kind of assistance. It is also paramount that future users are able to understand the usefulness of the system, and how they can benefit from it. The solution should explore the ability to increase both security and the ability to live independently to achieve this goal. Recommendations from other people that the future user looks up to and respects is also perceived as a motivational factor for adoption.

6.2 Implications for the Project

In what concerns the feasibility of a project with the characteristics of PersonAAL, the focus groups results gave us motives to believe that, not only there are no major restrictions against such a project, but that a product with these characteristics would be welcomed into current practice. We noted the following, in particular:

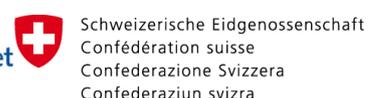
- The primary care location is the beneficiary's home, but also remote activities take place, so current practices are aligned with the project concepts.
- Economic concerns about the sustainability of current healthcare models have been expressed. PersonAAL can, potentially, contribute to decrease the financial burden on health and social care systems, thus it is also aligned in this aspect.
- Keeping up with the evolution of the beneficiaries' status after the initial assessment has been identified as one of the major limitations of current practices. Thanks to the deployment of monitoring devices and environments, PersonAAL has the potential to contribute by making more data available and accessible to those responsible for the accompanying of the beneficiaries.

For the future design of PersonAAL, and other solutions based on PersonAAL, we could identify the following design implications.

Health care professionals have expressed the desire to promote a care paradigm change from a compensatory approach, where care is based on compensating for known limitations, to a prevention based approach, where care would promote healthier lifestyles, thus mitigating the onset of these limitations. To contribute to this paradigm change, PersonAAL should:

1 – Incorporate the required sensing mechanisms that are necessary to interpret the beneficiaries' activities. These will support the development of applications to specify what

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activities should the beneficiaries perform, and the intelligence to detect if the activities are being attempted, and if they are being performed correctly.

The professionals warned that to support the intended lifestyle changes, it will be necessary to overcome unwillingness, anxiety and a general lack of initiative that characterizes the beneficiaries. To assist in this objective, PersonAAL needs to:

2 – Contemplate the inclusion of persuasion mechanisms that can exploit knowledge about its users to increase the awareness to the benefits resulting from the proposed lifestyle changes and the motivation levels necessary to implement the changes. The solution should not be dependent on the type of activity. It should consider application development targeting both social and physical activities aligned with the prevention care paradigm or rehabilitation activities aligned with existing compensatory care.

It is clear that, although individual assessments exist, and rehabilitation plans are prepared based on those assessments, the variability of beneficiaries' characteristics is still a matter of concern for the health care professionals. PersonAAL needs to address these concerns by:

3 – Collecting data about specific individuals and use that data in order to personalize or adapt both the services or applications that are supported, as well as the interaction mechanisms made available to users in order to be able to provide efficient care services and accessible applications that are useful and usable.

One specific deficit that was pointed out in the focus groups was the inability of the current monitoring procedures to detect the deterioration of cognitive abilities. To this end, PersonAAL needs to:

4 – Study which indicators can be monitored to detect deteriorating cognitive abilities and understand which of those indicators are feasible to measure through passive monitoring means (e.g. environmental sensors or wearable devices) or active monitoring (e.g. requests for the user to complete some activity or play a game). Based on this, PersonAAL should provide support to collect and store relevant data for applications that want to be able to detect the onset of declining cognitive abilities. Based on the other identified characteristics, applications to prevent this decline should also be supported by the underlying PersonAAL framework.

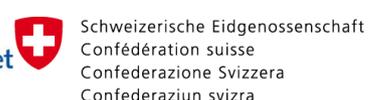
Another limitation of existing care services is the inability to detect changes in the beneficiaries' conditions quickly enough. This prevents more efficient interventions. PersonAAL could assist in this regard by:

5 – Supporting fine-grained monitoring, coupled with intelligent mechanisms capable of detecting deviations from previous patterns of the same user, to enable a more agile response by the caretakers. Optimally, this should be applicable to activity tracking, physiological measurements and cognitive evaluations. Furthermore, the patterns should be individualized, following the aforementioned principles of personalization and adaptation to individual users.

Given the nature of the data involved in a system that might be part of a health care workflow, the care professionals were adamant that such a system needs to:

6 – Respect the privacy mechanisms required by the legislation of the countries where it will be deployed. In particular, given the passive monitoring solutions envisioned, all users must be made aware of the on-going monitoring activities, and of their ownership of the data. This

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implies that PersonAAL based applications must ensure that their users have the ability to decide with whom they want to share which part of the available data.

Finally, one concern not directly related to the health care professionals, but that has been identified as having a major impact on the adoption of a system with the envisioned characteristics by the beneficiaries of care, is that it should:

7 – Blend in with the users' environments. In particular, any wearable devices, or environmental monitoring apparatus, should not make the user appear as someone in need of care.

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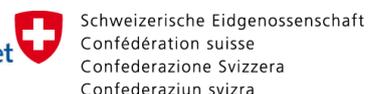
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7 CONCLUSIONS

The work conducted so far with health professionals supports the initial vision of the PersonAAL project: There is a desire to change the paradigm of care taking activities from a more compensatory approach to a prevention based one, which is driven by the need to decrease health care delivery costs. This implies being able to effectively support care at home instead of specialized institutions. These are the two main drivers of the PersonAAL project, which means that it is well aligned with professional care workers expectations.

The findings have identified a series of topics that need to be supported by PersonAAL to ensure its later adoption. PersonAAL should take sensing and monitoring to the next level, by endowing it with activity detection mechanisms. To ensure that preventive measures are more effective, PersonAAL should include persuasion mechanisms. Sensing, activity detection and persuasion should be uptake at the individual scale, thus promoting a truly personalised solution. To improve upon existing solutions, PersonAAL needs to include mechanisms that are sensitive to fine changes and able to detect the early onset of symptoms. Health professionals wished for better than existing support in what concerns detecting and managing senior's cognitive decline. PersonAAL's base mechanisms should be able to contribute to the development of solutions in this field. Finally, two topics that are relevant for all stakeholders are the need to develop solutions that address privacy concerns, and to design sensors and wearable devices that blend in with older adults and their living environment.

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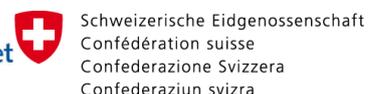
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ANNEX 1

The following tables present the list of codes resulting from the two rounds of code on the transcriptions of the focus group meetings. The first table groups the codes on the theme of Current practices. The following tables group codes on the themes of Limitations, Expectations and Concerns. All tables further group the codes into sub-themes and, in the final column, present the code's importance to the project's development. The first table has an additional column to further detail some of its codes into sub-codes.

Theme: Current Practices

Sub-theme	Code	Sub-code	Importance
Place	Home		High
	Elderly homes		Medium
	Nursing homes		Medium
	Remote		High
	Rehabilitation centre		Medium
	Municipality		Medium
	Hospital		Low
Condition	Chronic patients		Medium
	Dementia		Medium
	Heart disease		Low
	Lung disease		Low
	Mental illness		Medium
	Strokes		Low
	Orthopaedic issues		Low
	Limited mobility		Medium
	Loneliness		High
Frequency	Once		Low
	Continuous		High
	Several times a day		High
	Daily		High
	Trimestral		Medium
Type of service	Health/Nursing		Medium
	Social		Medium
	Public		Low
	Private		Low
	Multidisciplinary		Medium

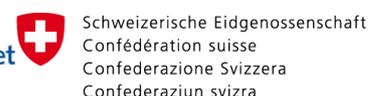
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Sub-theme	Code	Sub-code	Importance
Stakeholders	Older adults		High
	Formal Caretakers		High
	Informal Caretakers		High
	Nurses		High
	Nurse Assistants		High
	GP		High
	Physician		High
	Occupational Therapist		High
Assessment	Tools	iPlos	Medium
		"UK System"	Medium
		Letter of Care	Medium
		Enquiries	Medium
		Observation	Medium
		MMSE	Medium
		Others	Medium
		Outcome	Type
	Amount		Medium
	Diagnosis		Medium
	Quality		Medium
	Responsibility		High
	Measures	LTM	Medium
		STM	Medium
		ADL	Medium
		Social communication	Medium
		Remember to take medication	Medium
		Eating routines	Medium
Cleanliness		Medium	
Messiness		Medium	
Intervention	Rehabilitation		Medium
	Assessment	Motivation	High
	Tools	Task list	Medium
	Reporting		High
Trigger	Who	GP	Low
		Formal caretaker	Low
		Informal caretaker	Low

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Sub-theme	Code	Sub-code	Importance	
		Self	Low	
		Family	Low	
		Friends & Neighbours	Low	
	Why		Insufficient assistance	Low
			New symptoms	Low
			Episodes	Low
			Emergent care	Low
			Changing habits	Low
Technology	Phone		High	
	Fall detectors		Low	
	Alarms	Safety	Low	
		Fire	Low	
		Door	Low	
		Mobile (geo-fence)	Medium	
	Motion sensors		High	
	Smart House		High	
	Smartphones		High	
	Medicine Dispensers		High	
	Bracelets		High	
Necklaces		High		
Outcome	Economic		High	
	Behavioural		High	
Standards and Legal procedures	BIPS		High	
	"Push to care"		High	

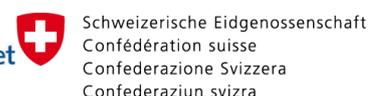
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Theme: Limitations

Sub-theme	Code	Importance
Challenge	Characterizing users	High
	Heavy Care tech/staffing needs	Low
	Load balance	Low
	Adapting new tech	Medium
	Able to follow instructions	High
	Perceived Benefits	High
	Unwillingness	High
	Lack of initiative	High
	Language	Medium
	Lack of healthcare professionals	Low
	Lack of informal caretakers	Medium
	Lack of nursing homes	Low
	Heavily staffed	Low
	Availability	High
	Minor changes	High
	Reach	High
	Sensitivity	High
	Specificity	High
	Early Catching	High
Systems	Rigid	High
	Narrow	High
	Slow	High
	General	High
Standards	Lack of experience	Low
Assessment	Useless	High
	Wrong assumptions	Low
	Cognitive evaluation	High
	Different people	Low
Paradigm	Compensatory	High

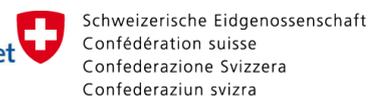
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Theme: Expectations

Sub-theme	Code	Importance
Suggestions	ICF Modeling	Medium
	Gamification	High
	Reminders	Medium
	Collaboration	Medium
	Family mediated communication	Medium
	Dual task	Medium
Paradigm	Prevention	High
	Capable Elderly as Providers	Medium
Systems	Adaptable	High
	Sensitive	High
	Persuasion	High
	Blend in	High
	Personalization	High
Technology	Sensors	High
	Tablet	Medium
	Computer Applications	Medium
	Telecare	Medium
	Health bands	High
	Voice synthesis	Medium
Outcome	Cognitive evaluation	Medium
	Functional Rehabilitation	Medium
	Early-detection	High
	Live independently	High
	Connectedness	Medium
	Promoting social activity	Medium
	Promoting physical activity	Medium
	Saves time	Low
	Saves money	High
	Accommodate different perspectives	Low

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Theme: Concerns

Sub-theme	Code	Importance
Stigma	Appearance	High
Anxiety	Fear	Medium
	Confusion	Medium
Acceptance	Independence	High
	Technology empathy	Medium
	Culture	Medium
	History	Medium
	Usefulness	High
	Adoption time	Medium
	Role models	Medium
	Familiarity	Medium
	Security	High
	Recommendation	Medium
Privacy	Monitoring	High
	Data ownership	High
System	Variability	High
	Failed Expectations	Medium
Approach	Keeping people safe	Medium
	Removing healthcare professionals	Low

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