Deliverable 2.1

Specifications of overall end-user requirements

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Abstract
The objective of this deliverable is to identify the end-users' requirements. User requirements aim to explain "What do users need the solution to do, and what do they want, taking into account their satisfaction?" The evaluation is based on qualitative research for understanding human behaviour (satisfaction, requirements, opinion, etc) in a specified context and its determinants and use appropriate tools for analysing facts in a measurable approach. The responses bring important information to offer the best product integrating technologies to support elders' health management and stay healthier and live a more quality life.

What is new in this version

This is the final version of the Deliverable, approved by the project consortium.

The Ella4Life project is co-funded by the European AAL Joint Programme

Version	***Date***	***Changes***	***Name***	***Organisation***
1.0	2018-11-01	Initial Creation, reviewing	Mircea Marzan	ANA
2.0	2018-12-05	Completing, analysing data, concluding	Magdalena Velciu	ANA

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Content:

1 Executive summary

The aim of the **Ella4Life project** is to support elderly people to stay healthier and live a more quality life. The proposed integrated solution, Ella4Life, helps people in need, in daily activities or to stay in contact with the professionals or informal caregivers and so living a more pleasant life, independent and safe at home. Ella4Life is presented as a virtual avatar, integrating the technology that Anne and Emma already offered and integrating the use of the bath sensor and the e-chair. In doing so, Ella4Life offers people one solution for care and cure as a best-added value for the target group.

User involvement and specification of user requirements are an essential phase to ensure that elderly people's requirements and needs are in-depth investigated and respected by the Ella4Life solution. Their involvement is important to create an integrated solution bringing together three different solutions and technologies (Anne, Emma, sensors). Also, analysing user requirements is necessary to guide the consortium to develop a product which is useful, competitive, with high acceptance on the market.

The report evaluates the end-users' requirements in order to understand the needs of elderly people in daily activities or stay in contact with professionals or informal caregivers. The research objectives are:

- to identify and analyse the true needs of elderly people taking a measurable approach and employing qualitative methods
- to assess the requirements, expectations, and preferences regarding an integrated solution Ella4Life, revealing all factors that influence the decision making process.

Concerned whether we were developing the right product, we invited elderly people who are potential end-users of the integrated solution to have a look at it and to share their opinion with us. Users are persons who agreed to use the solution Ella4Life to their advantage. We have inquired people from Romania, Poland, Netherlands, and Switzerland, as end-user organizations.

The evaluation is based on **qualitative research** for understanding end-users demands in a specific context, and uses appropriate tools to capture results. Data have been collected by focus groups and semi-structured interviews with primary end-users to evaluate their requirements and expectations for each element of the integrated solution Ella4Life. Themes for qualitative insights or numerical comparisons have been employed.

Focus groups discussions and semi-structured interviews show that the majority of the participants understand Ella4Life as being of real help to elders

who need support. The Dutch group share a more preventive approach to the Ella4Life solution, suggesting to be adopted in stages, based on the user's state of frailty, while the Romanians suggested to customize the application to the specific needs of each person. If all appreciate the support E4L gives for an independent living, the group from Poland look at the solution as being unrealistic. Some cultural differences have been also acknowledged, such as: the Swiss emphasize the cons specific to technologies, the Duch share a preventive approach and Romanians look for more information, connection with people and medical coverage.

The research findings reveal end-users experience. Many participants felt comfortable with the Ella4Life concept and would be happy to make use of such service, while the reservations of a significant number of participants should also be considered: the concept needs to be more clearly explained (Poles, Romanians and the Swiss), lack of enthusiasm towards its acceptance (Swiss), the believe that it is unrealistic (Poles). Interestingly, the fact that the Poles' look at the concept as being unrealistic might be either catastrophic for the Polish market, or a great marketing strategy. The majority of the seniors appreciated the interaction with a virtual assistant who can give them real time advice and useful information on agenda, news, weather, medication notifications and video calling. Most of the participants appreciated the monitoring and self-management for measuring blood pressure and the reminders for medication, as well as the online interaction, though some expressed reservation about its utility. All appreciated the presence of the sensors in the armchair, while only seniors from Romania and Poland appreciated the presence of sensors in the bathtub. The sensors's implementation all over the house and even outside it through tracking would improve their sense of security. Other sugestions for improvement and ideas were offered by all participants engaged in the testing.

Elderly people are interested to benefit from new technologies and discover the opportunities they offer. The cultural perception of the technology should be consider for the further development of the product.

2 Introduction

The aim of the **Ella4Life project** is to support elderly people to stay healthier and live a more quality life. The proposed integrated solution, Ella4Life, is designed to support people in need in daily activities and to stay in contact with the professionals or informal caregivers and so living a more pleasant life, independent and safe at home. Ella4Life is presented as a virtual avatar, integrating the technology that Anne and Emma already offered and integrating the use of the bath sensor and the e-chair. In doing so, Ella4Life offers people one solution for care and cure as a best-added value for the target group.

The present report aims to assess the end user's needs and requirements as part of testing the iterative prototypes. Results will be used for developing the final integrated solution Ella4Life. We are determined to offer the right product in terms of usability, reliability and efficiency.

Research objectives are:
- To identify and analyse the true needs of elderly people taking a measurable approach and employing qualitative methods.
- To assess the requirements, expectations, and preferences regarding an integrated solution Ella4Life, revealing all factors that influence the decision making process.

3 Methodology to assess end-user requirements

3.1 General considerations

User participation is a strategy to ensure that the requirements and needs of elderly people are known and respected in every stage of the project. End-users are already involved in the development of the three existing different solutions and technologies (Anne, Emma, sensors). We concluded that we need to cooperate to create an integrated solution instead of three different ones. Moreover, the analysis of user requirements is necessary in order to guide the consortium towards the creation of a product which is useful, superior and with a high degree of acceptance.

Research on user participation has at its core the idea that user participation in the design of the proposed solution leads to a better product. The involvement of users stimulates a good understanding of the system and the product will be better tailored to their specific needs. There is a relationship between user involvement, system usage, and user information satisfaction which will be discussed below.

User requirements aim at clearly articulating statements about *"What do users need the solution to do, and what do they want, taking into account their satisfaction?"* The evaluation is based on **qualitative research** for understanding human behavior (satisfaction, requirements, opinion, etc) and use relevant tools to analyze opinions in a measurable approach.

Qualitative research methods employing focus groups and semi-structured interviews are used to gather qualitative information that is considered relevant to explore new ideas and the development of an integrated solution Ella4Life. The discussions are focused on the innovative solution Ella4Life and three different solutions (Anne, Emma, sensors) and investigate the benefits of an integrated solution. The aim is to apply the strengths of each product in the creation of a superior, integrated product. Data and results have been collected by using focus groups and semi-structured interviews with end-users to understand their needs,

requirements, and expectations for each element of the project solution Ella4Life. Data has been analyzed by themes and numerical comparisons.

3.2 User recruitment process

Defining the user: Senior adults who will benefit from integrated solution Ella4Life, within the category 55 years and older, healthy or with a chronic disease or mental condition. The representation of the user characteristics is very important. They reflect the potential users of the proposed solution.

The group is recruited voluntarily, persons who usually do not know each other but can share their experiences and express their opinion. These persons have been requested to offer their feedback and opinion about the integrated solution Ella4Life.

The **segmentation criterion** gives the group homogeneity based on the same demographic characteristics. The selection criteria are: age, health status and at least a basic experience of using technology. The gender, the urban/rural residence or level of education are not relevant for our research.

The end-users will form a natural reflection of the demographics of the participating countries. According to **the age** criterion, we selected persons aged 55 years and older, in three ranges: 55-65; 65-75 and 75+ years, preferably with a balanced distribution.

According to the **health** status, the target group is formed by healthy persons who are active, or persons with minor problems of health, receiving treatment or not.

We are interested in people with a minimum level of experience in ICT (information and communication technology), mobile apps and the online environment because the Ella4Life solution is based on technology and person-computer interaction.

There were five end-user organizations from four European countries.

- Ana Aslan International Foundation - Romania (coordinator of T2.1.)
- Livelife - Netherlands
- Muflon - Poland
- iHomeLab, Hochschule Luzern – Switzerland
- Vicino Luzern -Switzerland

Organizations used their network of collaborators (seniors, volunteers, professionals, caregivers, etc.) for the questionnaires' distribution, data collection and the organization of focus groups and interviews.

3.3 Focus group methodology

The purpose of these focus groups was two-fold:

1. Firstly, we define the specific needs, requirements of users concerning the description, use and implementation of the product (integrated solution Ella4Life) in order to understand elders' requirements and to build the right solution for them.

2. Secondly, we involve the end-users in the co-design and development of a superior product about revealing the best solution desired.

For completing the user consultation exercise we will run focus groups with the user organizations (ANA, Livelife, Muflon, iHome Lab and Vicino Luzern) who are currently partners within the consortium.

Selection of the participants for the focus groups are primary users more likely to be the target beneficiaries of the Ella4Life technology, mainly elderly people having an interest in using the Ella4Life product. Demographic data of the participants is collected.

All participants in the focus group should be offered a short, introductory presentation of Ella4Life concept, referring to its features and benefits relating to primary users before the discussion begins. Moreover, a short preview or demo of the virtual avatar Anne and presentation of Emma, e-bath and e-chair sensors should be tested by the participants.

For each focus group, the following rules and guidelines are applied.

The focus group facilitates discussions between six and ten people led through an open discussion by a moderator. The group needs to be large enough to generate rich discussion but not so large that some participants are left out.

The focus group moderator needs to nurture and encourage the discussion in an open and spontaneous format. The moderator's goal is to generate a maximum number of different ideas and opinions from as many different people in the time allotted. The ideal amount of time to set aside for a focus group should last from 45 to 90 minutes.

For each focus group, the guidance questions should enable us to have an open dialogue with participants, stimulating their thinking and generating views and opinions. Focus groups are structured around a set of guidance themes, as following:

- Ella4Life's concept and interaction with a non-human assistant, platform and sensors.

- Presenting the structure and content of three products (Anne, Emma, sensors) so far developed.
- Discussing technology and interaction, measuring heath parameters, recordings and advice intermediate on the platform.
- Encourage personal opinions (barriers, comments, questions or ideas regarding the Ella4Life solution)

For each focus group, we followed a broad structure of themes to address all key issues concerning the Ella4Life solution. We must remember that the ultimate purpose of this activity is to generate feedback and opinion that will help in prioritizing the development of the Ella4Life solution. The guidelines are presented in Annex 1.

The discussion should be completed by a guided interview that will need to be filled in by every participant. The guidelines are presented in Annex 2.

Ideally, comments will stimulate and influence the thinking and sharing of each participant. Some people may even find themselves changing their thoughts and opinions during the discussion.

It takes more than one focus group on any topic to produce valid results – usually three or four. Due to the ground that we need to cover, it might be useful to run each of the focus groups twice or three times with a different audience involved each time. Focus group participants won't have a chance to see the questions which are to be asked.

There are three types of focus group questions:

- Engagement questions: introduce participants to each other and make them comfortable with the topic of discussion
- Exploration questions: get to the core part of the discussion
- Exit question: check out if anything was missed in the discussion

Analyzing the data

Comments should be summarized, and the essential information using a systematic and verifiable process, needs to be noted. The process starts with the transcription of all relevant parts of the focus group recordings and notes are to be inserted into transcribed material where is needed. The transcripts should be cleaned up by stripping off nonessential words. Common themes should be identified in the responses for each question. At the end, write a short paragraph summarizing findings for each question and add quotes to illustrate key points where appropriate.

In this phase of the project, we will use the focus group questions and questionnaires only for the senior primary users (the users who will benefit directly from the Ella4Life solution). The other relevant stakeholders (i.e. the caregivers) will be involved in the next step of the research.

3.4 Semi-structured interviews' methodology

One important part of our work focuses on assessing end-users' needs and requirements, while testing the iterative prototypes. The analysis of the user requirements is necessary to guide the consortium towards the integration of all three elements and create an innovative solution which is useful, superior and sharing high acceptability.

For this purpose, we set the following particular **operational objectives**:

- Gathering of opinions and perception about solutions proposed by Ella4Life such as interacting with the virtual assistant, types of general information/advice, self-management coaching tool, the presence of sensors. etc.
- Attitudes and behavior, and barriers in connection with proposed solution
- Actions of using new technologies, internet and app in an on-line environment.

Semi-structured interviews provide a fast and efficient method of gathering information with regards to the user requirements and reveal the real needs of end-users. **The interview guide** is designed to identify requirements, collect information and structure the opinion of the end-users. We choose this tool for its efficiency and efficacy. Semi-structured interview allows end-users to reflect on their responses carefully without pressure of time or other interruptions. **The questionnaire is semi-structured**. The questions have a multiple-choice, rank-order scale or open-ended possibility, where appropriate. The guide can be found in *Annex 2*. Each questionnaire has a letter attached introducing the theme and objectives of the project. Face-to-face questionnaires are conducted where the interviewer presents the items orally. Collecting data through personal administration improve the responses rates.

Exploratory data analysis reveals the core information regarding end-user requirements. The results are structured to identify the main practices and behavior of persons and a deeper understanding of the concepts.

4 Analysing the user requirements

4.1 Findings from focus groups

Overall, we received a positive evaluation of the Ella4Life solution concept and its elements. Though, significant cultural differences exist on the perception of Ella4Life integrated solution.

4.1.1 Findings from Romania

Participants:

On November 22, 2018, specialists from *Ana Aslan International Foundation* conducted a focus group in order to evaluate the users' requirements regarding the implementation of the Ella4Life integrated solution. The selected group included 8 persons over 55 years old, females, who have at least basic ICT's knowledge and agreed to participate in the discussions.

The discussion targeted the proposed objectives (see Annex 2).

1. Firstly, seniors were informed and presented with the projects objectives and *integrated solution Ella4Life*. We focused on the idea of having a virtual assistant learning personal preferences and habits, monitoring certain health parameters and helping them with adapted suggestions and advices. Simply presenting information, using graphics schemes, pictures, movies, was a plus.

2. About the Ella4Life concept and its services

The Ella4Life solution was generally appreciated as being **very interesting**. The benefits were clear and well represented in seniors' opinion. They need help and agreed on receiving it, in the form of monitoring health indicators, provide advice and information. **It was perceived as real help to elders who need little support.** It was suggested to customize and adapt the application to the specific needs of each person, individually. In their opinion, it must provide a **personalized response** to the specific characteristics of each person or medical history (preferences, specific needs, topics of interest, etc.). For example, the patient could take the tablet with him to the doctor's office. As a preliminary conclusion, they know what they want, and would accept a new product only if it is be a real help in their daily life.

The conditions are: to be easy to use, easy to learn how to access and have the family agreement for high security.

It would be better for them to have the voice control accessibility.

3. About Anne – virtual assistant

Regarding the interaction of the person with the **virtual assistant (Anne)**, participants' had a positive opinion because all value communication. They are willing to share information and to interact with others. For example, they suggested the possibility to build a group of 2-3 persons with the same interests and share information. Seniors value connections and the idea of being involved and stay active. The virtual environment can give them the support and therefore, they agreed with the idea of interacting with a non-human assistant. **Interaction and sharing information are essential features**.

More diverse information shall be added to the platform. Participants valued activities for training their minds. They suggest including information such as professional advice (medical articles, opinions), motivating a positive state of mind, and including the possibility to chat with other persons.

4. About Emma

The participants think that having certain health parameters measured is a valuable feature, along data recording and the prospect of creating personal history. **Though, the advantages of sending data on a platform were not clear, yet**. Instead of just receiving advice through the platform, people emphasize that it is better to have the doctor's consent, or even a contract (agreement) because people trust doctors. Self-management of health condition is not desired without medical prescription.

5. *About sensors*

Seniors enjoyed the idea of having sensors for monitoring their movement or possible incidents (falls, heart attack or lose consciousness lost). Elders are aware of their fragility. Beside the sensors in bathtub, participants believe that it would be better to have, for example, some sensors located all over the house, to alert caregivers. That would give them **a sense of security.**

It is important to know if the signal is sent either to a local emergency or to the family. The presence of electrode-type of sensors in an armchair allowing long-time ECG measurements is appreciated only if the recordings are sent to the doctor, through a secured connection.

Participants positively appreciate having a device that allows their localization. They suggested a tracking bracelet to locate people with orientation problems when traveling.

6. *About the technology: the experience and attitudes are positive*

The participants' experience of using mobile and app-based technology is not extensive, but they are comfortable with using apps. They all have a mobile phone, many have smartphones, and they are aware of the benefits of using new technologies. Even if it is difficult for them to learn, they are willing to understand how to use a tool that will improve their quality of ageing.

7. *Generally (barriers and other proposals)*

Firstly, participants referred to the high price for acquisition as a relevant barrier. Secondly, they hesitated to be monitored and fear to send personal data and medical records to unknown destinations and are distressed that unknown persons may have access to the their data. Lack of trust is a factor that could stop elders from using the Ella4Life solution.

Participants had some comments regarding the Ella4Life solution. They emphasized the idea of accessibility, for instance, the availability of voice-activated technology for an easy to use interface, especially for those with eye and vision impairments. The possibility to use the application in the absence of PC skills. A tutorial and step-by-step guide has been suggested as a solution to PC illiteracy.

The participants expressed their opinion regarding integrated solution Ella4Life coverage. It should be able to monitor the following health problems:

- cardiovascular diseases, fluctuating blood pressure.
- respiratory diseases,
- diabetes and metabolic effects,
- psychological disorders
- neurologically (including 'losing balance')

In conclusion, seniors had a good understanding of the virtual interaction. They think that the idea of having a virtual assistant which speaks, offers support with adapted medical advice, personalized monitoring of health indicators was very interesting and useful. Participants' perception is favorable to accepting new technologies in their lives. They were aware of the benefits of having a modern application that gives them a sense of trust, security, and bridge the connection between seniors, caregivers, and doctors.

4.1.2 Findings from the Netherlands

All participants thought the concept of Ella4Life was **amazing**. Yet they all believed that the concept would only land in the market when it was offered as a serviced

solution meaning that the concept gets installed at their homes and that every 6 month an **advisor** visits them to discuss the functionalities.
All participants strongly believed that most people would start with a basic type of Ella4Life - without sensor's or another form of home automation - but would need these other functionalities in later moments of their lives and that their main concern was the concepts price. Due to this concern, they advised us to sell the product as a serviced solution with a **small monthly fee** instead of one big investment in the beginning.

Participants:

We recruited the participants online by emailing our **Livelife** test panel asking volunteers to apply for our focus group session. Eight people responded yet three of them had to cancel due to other planned activities. All participants were between the age of 65 and 75 years old and had some experience with using smartphones. Two also had experience with using tablets and personal computers. All five (4 female, 1 male) participants were presented the integrated solution Ella4Life during the focus group meeting.

Method:

After presenting the integrated solution Ella4Life we invited the participants to an open discussion about needs, requirements and financial feedback. Finally, they completed a questionnaire attached to the discussion.

Discussion:

- One participant asked us if Ella4Life would be able to register sleep apnea and wake the person up when he/she fails to breathe normally during the night by speaking or making a sound.

- Most participants hoped that Ella4Life would also work on a smartwatch so that they can **carry** the concept with them wherever they go.

- All participants argued that although they absolutely loved the **chair sensors** (feeling of being safe while being monitored) yet they saw no use for the bathtub sensors. The participants argued that people from their age never use the **bathtub** anymore except for giving their grandchildren a bath. Most of the participants mentioned that because of slight back problems they always take a shower instead of using the bath. They advised us to integrate bathroom sensors into Ella4Life which should be able to register if an individual fall down in the bathroom instead of monitoring just the bathtub.

- Most participants believed that most people would first want to just buy the **voice recognition** part of Ella4Life (which they later defined as the 'basic Ella4Life') because most people would want to buy it before they actually have fears for accident or decreasing health. They argued that some potential buyers would first buy this basic concept – due to financial capabilities – in order to later on accept the additional features like medication- or sensor monitoring.

- Advisor should take their time to explain all the features!

  Advice:

- Offer a '**basic' solution** (the voice recognition software) with a low price and offer additional extra options (sensors, medication etc) and be really clear about what these extra options do and what they cost.

- Offer a service **contract** to the market in which a service desk professional would come without extra costs to fix problems at home. This contract should also include an advisor paying the customer a visit every 6 months to discuss whether Ella4Life in its current form is still fine or that additional features need to be activated.

- Ella4Life should be able to work on a **smartwatch** too. The participants all loved the idea that Ella4Life is with them 24/7 – even outdoors – and didn't mind a bigger smartwatch if that was needed.

- Creating sensor tools (controlled by Ella4Life) that can detect if someone is falling in either the bathroom or the living room.

- Creating sensors which can be carried outdoor as well, for example, integrating them in existing corsets.

4.1.3 Findings from Poland

On the 13 of November, 2018, a meeting of seniors and guests of the Muflon Center took place. 22 people took part in the coaching session, 19 people filled out the questionnaire. The meeting lasted 1.5 hours. The participants of the meeting were people living in small towns and villages. The Ella4Life project seemed **unrealistic** to the participants, impossible to implement. Seniors assessed their situation as difficult. A trip to rehabilitation is a huge effort, having and using a telephone is the top of the possibilities. The Ella4Life project seemed to be very interesting but impossible to implement during the lifetime of the participants.

4.1.4 Findings from Switzerland

In Switzerland, 97% of the population over the age of 16 have a smartphone. For this reason, apps are widely accepted and used. Among the interviewees in the focus group, all had a smartphone and used it regularly. Everyone was very interested in apps that promote health. The topic of self-tracking is very popular in Switzerland. The topic of blood pressure measurements at home has been rated as very important. About the sensors in the bathroom, all people were negative. Bathing is no longer desired in old age. It is important to everyone involved that the system functions reliably and trouble-free. However, IT security must always be maintained. The following points were identified during discussions:

Critical statements:

- The E4L system is another technology that contributes to total surveillance. As this technology is mostly used in private homes, there are considerable concerns.
- The freedom to shape everyday life according to personal ideas and self-determination can be lost. The system imposes a fixed everyday structure.
- Talking to an avatar can lead to loneliness. A person is no longer required to deal with other people. The ability to have a coherent conversation can be lost. In communication, it is important to get the direct emotions of the other person. The use of an avatar should be limited to some previously defined time intervals per day.
- You no longer think for yourself. E4L reminds you of everything.
- If the system fails and you rely on the memory of taking medication, this can lead to life-threatening situations.

Positive expressions:

- The system can help people who have no or only a disordered daily structure. The appointments can make it easier to return to a structured everyday life.
- To live independently in an apartment can be enhanced by E4L. Everyday minor problems can be overcome easily.
- Training - fitness data can be easily collected and evaluated. The alarm function in the Emma system when limit values are exceeded is certainly helpful. The forwarding of measured values and alarms is a good function.
- Other functions that are considered helpful:
- To motivate people to move more via E4L.
- Search for telephone numbers
- Query of local public transport connections

- Save missed phone calls and reminding you to call back. Especially interesting for people with a hearing impairment, who in some situations have poor hearing.

4.2 Findings from interviews

After the proposed integrated solution was presented to elders, they were asked to share with us their insights. The discussions with end-users revealed important information concerning the use and design of the Ella4Life solution.

The respondents. Our interviewed groups included people over 55 years: 8 persons in Romania, 5 persons in the Netherlands, 7 persons in Poland and 8 persons in Switzerland. They had different levels of knowledge of the mobile and app-based technology or internet platforms. In Romania, the group included 2 persons with age between 55-64 years and 6 persons with age between 65-74 years, and all of them were women. In the Netherlands, the group included 5 persons with age between 65-74 years, 4 women and 1 man. In Switzerland, the group included 8 persons, from which one was under 50 and five of them were 50-55 y. and 2 individuals were 56-60 y., 5 women and 3 men.

The participants' answers confirmed previous insights from focus-groups.

Q1. Engagement

From a total of 28 participants, half of them understood the Ella4Life concept (15), and one third of the participants understood the main points of the concept (9).

In Romania, 5 out of 8 persons declared that the concept was clearly articulated and they understood the purpose of the solution, while other 3 persons said that they understood the main points of the Ella4Life concept. In the Netherlands, all 5 persons declared that they fully understood it. In Switzerland, 5 out of 8 persons declared that they understood the purpose of the solution and the other 3 persons said they understood the main points of the Ella4Life concept. In Poland, 3 out of 7 persons declared that they understood the idea, one stated that the concept is untestable, and 3 persons asserted that they were not entirely clear in terms of understanding the concept.

Q2. The acceptance of using Ella4Life (the attitudes)

Most of the participants showed positive attitudes towards the acceptance of a new technologies in their lives, except for the Swiss participants who manifested more reservation.

Generally, participants felt comfortable about Ella4Life idea and would be happy to benefit from the service as following: in Romania, 7 persons out of 8, all participants from the Netherlands, 5 individuals out of 7 from Poland and 3 persons out of 8 in Switzerland.

Few people had mixed feelings about the Ella4Life idea and felt that they need more information about that concept. This was the case of 1 person in Romania, 2 persons in Poland, and 3 persons in Switzerland. Only 2 participants from Switzerland declared: "I am not comfortable about the Ella4Life idea and I would not consider it".

It was noted that data security should be a top priority along the reliability functions. Some participants expressed anxiety towards the idea of 'total control' and one person even declared that there could be fatal consequences if one relies only on Ella4Life.

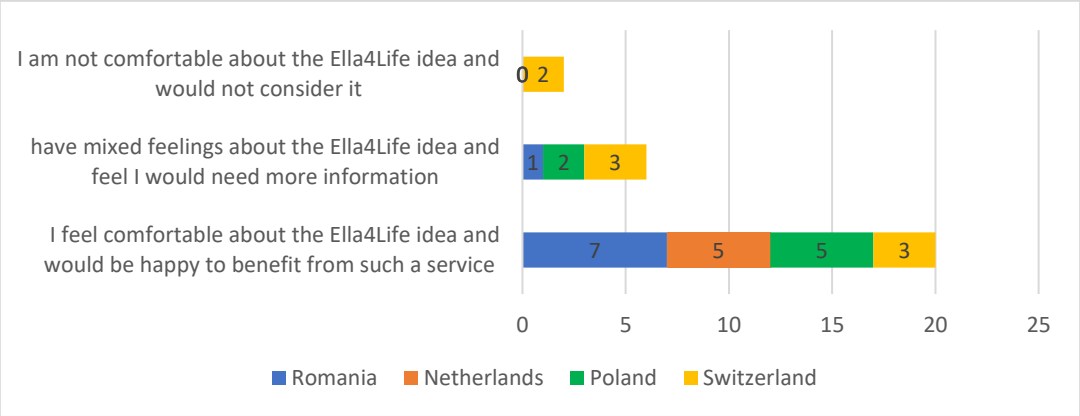

Figure: What is your view of the Ella4Life idea (multiple choices)

Q3. Interacting with the virtual assistant

In general, most of the participants appreciated the benefits of interaction and connection, receiving advice and useful information in real-time.

Interacting with a virtual assistant will be beneficial to elders as it supports them in many ways. Most of the respondents from Romania, Netherlands and Switzerland, and some from Poland, expect virtual assistant to offer useful **information in real-time** (6 persons in Romania, 5 in the Netherlands, 3 in Poland and 7 in Switzerland).

Most of the respondents from Romania, some from Switzerland and only few from Poland and Netherlands declared that interaction with a virtual assistant may offer

them pertinent advice and coaching when needed, (7 persons in Romania, 2 in the Netherlands, 1 in Poland and 4 in Switzerland).

When asked if the presence of a virtual assistant would help seniors to improve their mood when they feel down, most of the participants from Switzerland agreed while the respondents from the other countries manifested more reticence. There were only some from Romania, the majority from Netherlands, all from Switzerland and only one from Poland who agreed (3 persons in Romania, 4 in the Netherlands, 1 in Poland and 8 in Switzerland). By contrast, 5 persons in Romania, 4 in the Netherlands, 5 in Poland and only 3 in Switzerland believe that a virtual assistant would help to stay in contact with family members and /or friends. Some appreciated that it would help to get in contact with a doctor when needed (3 persons in Romania, 4 in the Netherlands, 5 in Poland and 5 in Switzerland).

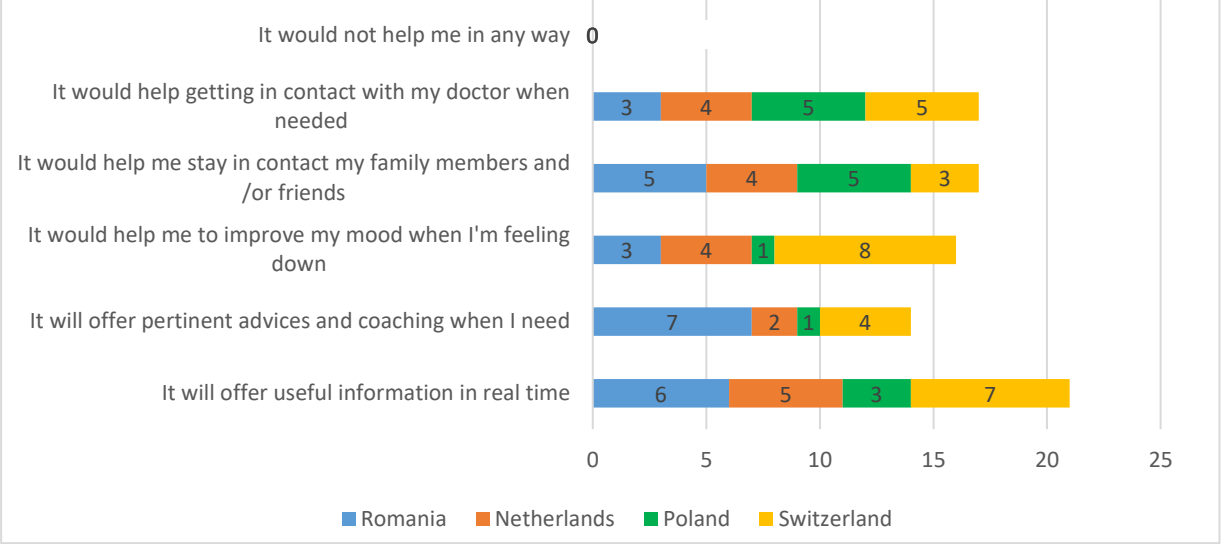

Figure: Interacting with a virtual assistant (multiple choices)

Q4. Type of Information

Most of the participants positively appreciated the information feature, especially agenda and news, weather info, medication, notifications, and video calling. We may note the need of the elders to stay informed (news and medical advice) and in connection with others.

Overall, some participants preferred Agenda and News (11 persons, 6 in Romania and 5 persons in the Netherlands) followed by weather information, while some respondents were interested in critical information about medication (9 persons, 4 in Romania and 5 persons in the Netherlands) and notification about medication and personal agenda. Most respondents from Poland and all from Switzerland (6

person in Poland and 8 persons in Switzerland) showed a high interest in local news. Participants from Switzerland also show a high interest in music selection (1 person in Poland and 8 persons in Switzerland) and events nearby (4 persons in Poland and 8 persons in Switzerland).
Moreover, seniors wanted 'search functions' for addresses and/or telephone numbers and local bus connections.

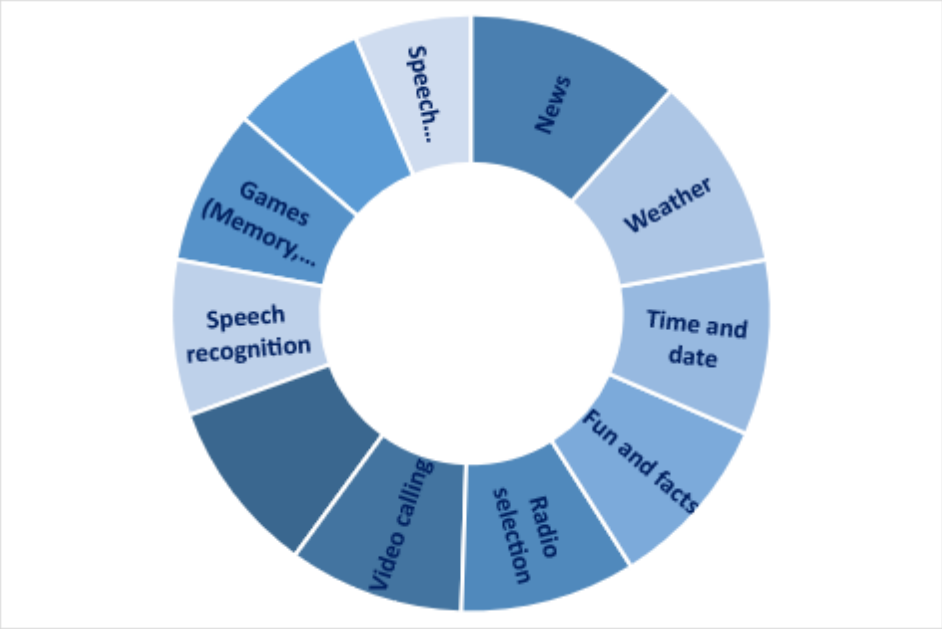

Figure: Type of information/advice preferred (multiple choices)

*Q5. Regarding adherence-to-treatment and self-management coaching of integrated solution Ella4Life (information controlled on **platform Emma**)*

Most of the participants believe that the proposed tool for treatment and self-management is important.

Reminders for measuring blood pressure was appreciated by most of the participants and some from Switzerland: 7 persons in Romania, 5 persons in the Netherlands, 6 persons in Poland and 4 persons from Switzerland. A similar positive appreciation was given to the feature of **Reminders for taking medicines:** 6 persons in Romania, 5 persons in the Netherlands, 6 persons in Poland and 6 persons from Switzerland. The number of people who accepted weight measurements is as following: 6 persons in Romania, 5 persons in the Netherlands, 2 persons in Poland and 1 person in Switzerland.

Most of the participants from Romania and Netherlands were interested in online interaction with family members, respectively 6 persons in Romania, 5 persons in the Netherlands, 2 persons in Poland and 1 person from Switzerland. Some elders appreciated online interaction with the healthcare provider: 6 persons in Romania, 5 persons in the Netherlands, 4 persons in Poland and 3 persons in Switzerland.

Easy to use planning tool for health-related actions and activities was of interest for many from Romania and Switzerland and only for a few from the other two countries (5 persons in Romania, 2 persons in Netherlands, 2 persons in Poland and 5 persons in Switzerland).

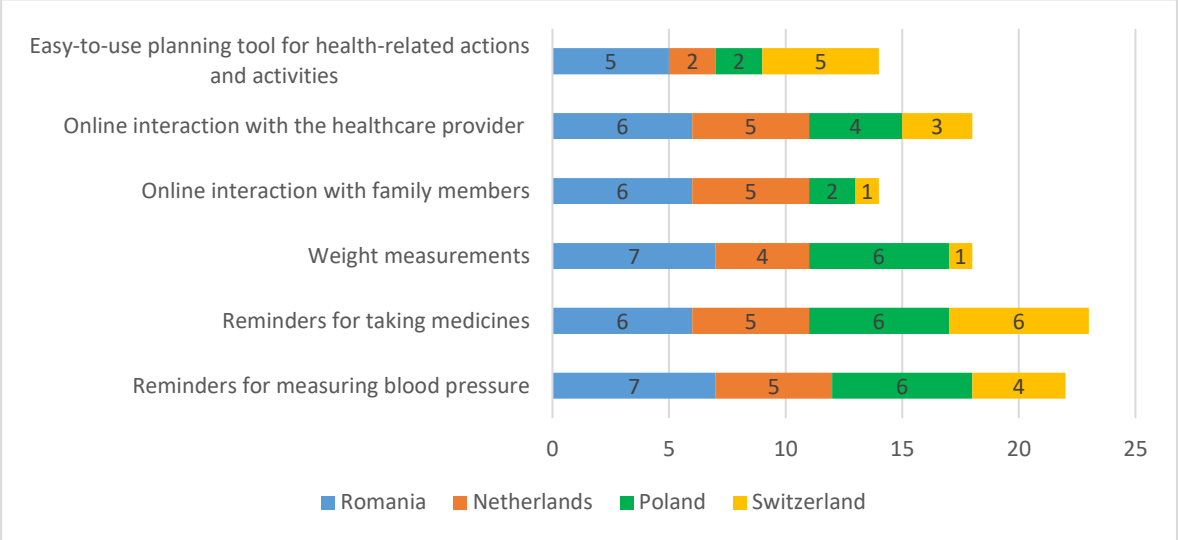

Figure: Regarding the adherence-to-treatment and self-management coaching tool provided by Ella4Life solution, what features would you consider important and useful? (multiple choices)

*Q6. Regarding the **sensors** in the bathtub and in the armchair*

a) Regarding the sensors in the bathtub, we obtained different conclusions and lessons learned. In the Netherlands, a few persons considered their presence important, because they don't use a bath tub but a shower. Only people from Romania and Poland positively appreciated the presence of sensors in bathtub to monitor the water level and water temperature (5 persons in Romania, 1 person in Netherland and 6 persons in Poland). Also, the majority of respondents from Romania and Poland needed **automatic water cut off and water dump if dangerous conditions were detected** (8 persons in Romania, 1 person in Netherland and 6 persons in Poland). The monitoring of the activity of a bathing person (e.g. sleeping, falling down) received positive appreciation from 6 persons in Romania, and 5 persons in Poland. Monitoring heart activity, e.g. detecting arrhythmias during bathing, is a feature also valued by people from Romania and Poland: 5 persons in Romania, 1 person in the Netherland and 7 persons in Poland. The same results were received regarding the automatic triggering and distribution of alerts for accidents during bathing (e.g. assistance required, heart attack, etc.) (7 persons in Romania, 1 person in the Netherland and 5 persons in Poland).

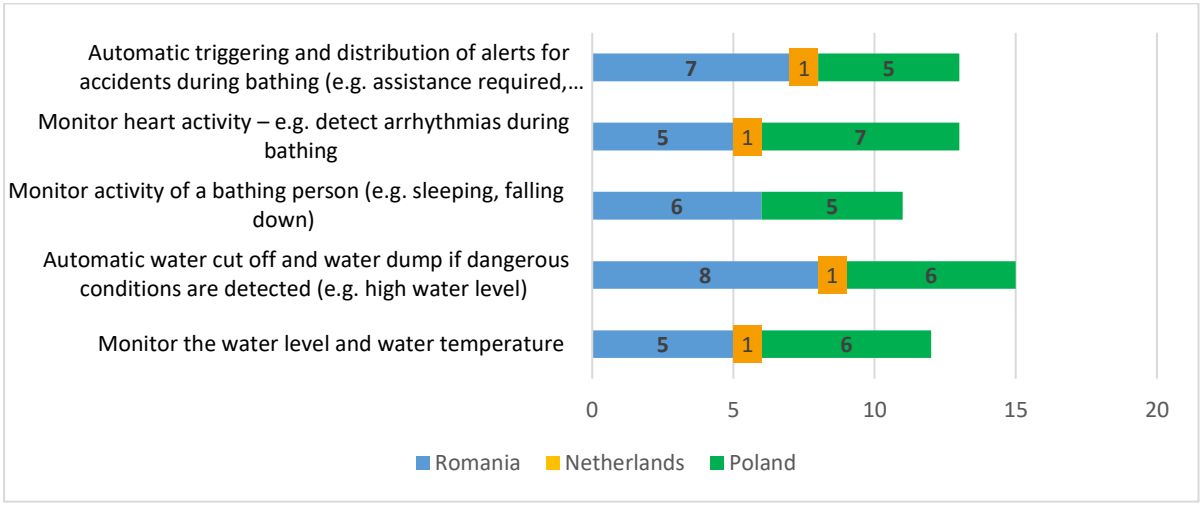

Figure: The presence of sensors in the bathtub (multiple choices)

b) Regarding the presence of sensors in the armchair, participants from Romania and Netherlands appreciated positively the offered features. Most of the respondents (5 in Netherlands and 7 in Romania) appreciate automatic triggering and distribution of alerts. Also, elders (5 persons in the Netherlands and 6 persons in Romania) appreciated the detecting of the heart arrhythmias and some wanted personal (heart) data collected (3 persons in the Netherlands and 7 persons in Romania).

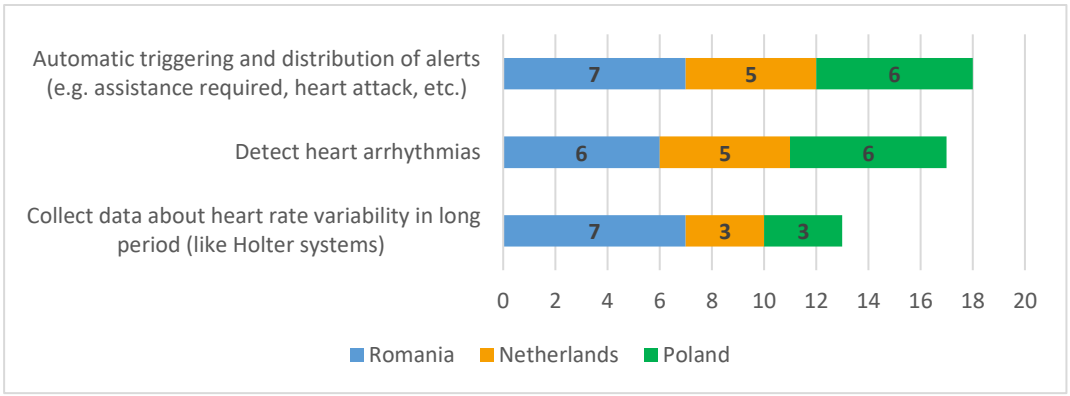

Figure: The presence of sensors in the armchair (multiple choices)

Q7. Proposed service/features

Participants from the Netherlands believed that the following features, that were not included in the Ella4Life platform, might be very useful:

- Sensors in the bathroom able to detect falling (5 persons)
- Sensors in the living room able to detect falling (5 persons)
- Sensors in the kitchen able to detect falling (3 persons)

Elders from Switzerland proposed another type of service that might be very useful to be included:

- Reporting missed calls (hearing deficits)
- Social contact count (loneliness)
- Evaluate and communicate training data
- Send messages (1 person from each country).

Q8. Usage of mobile and app-based technology

Some participants use today a smartphone to access apps daily, (5 persons in Romania, 2 persons in the Netherlands, 1 person in Poland and 6 persons in Switzerland). Fewer respondents declared that they use a tablet every day (3 persons in Romania, 2 persons in the Netherlands, 3 persons in Poland and 1 person in Switzerland). Very few from Romania and Netherlands have a mobile phone which is not a smartphone: 1 person in Romania, 2 persons in the Netherlands, though most of the participants in Poland, namely 6 persons. Very few of them have a tablet and they mainly use it for entertainment: 1 person in Romania, 2 persons in Poland and 1 person in Switzerland.

As a first conclusion, people who have devices that allow the use of applications (smartphone, tablet, even PC, but no smartwatch) use them for entertainment.

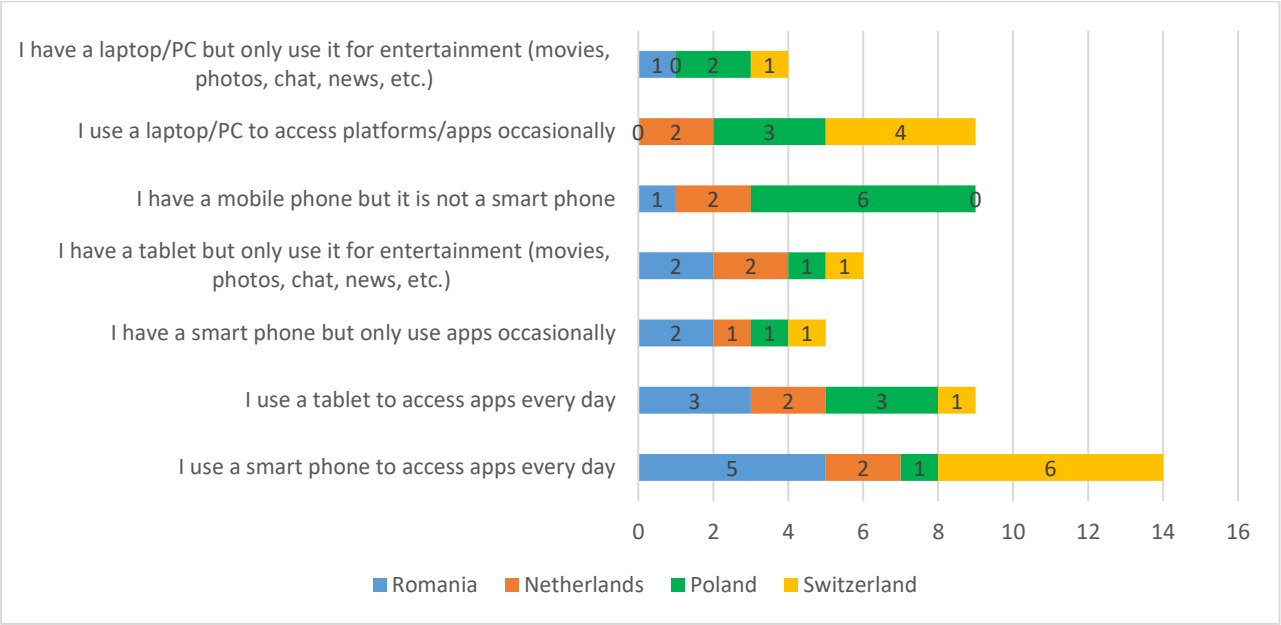

Figure: Usage of mobile and app-based technology

Q9. How comfortable are you with using apps?

Seniors use applications when they need and are willing to learn how to use them. Just a few respondents declared that they were very comfortable using apps, except for the seniors from Switzerland: 1 person in Romania, 2 persons in the Netherlands, 2 persons in Poland and 6 persons in Switzerland. Some of the participants from Romania said that they were comfortable with accessing apps though they needed to improve (5 persons in Romania, 1 person in Netherland, 1 person in Poland and 1 person in Switzerland). Few persons declared unconfident and ready to learn (3 persons in Romania, 1 person in Netherlands, 2 persons in Poland).

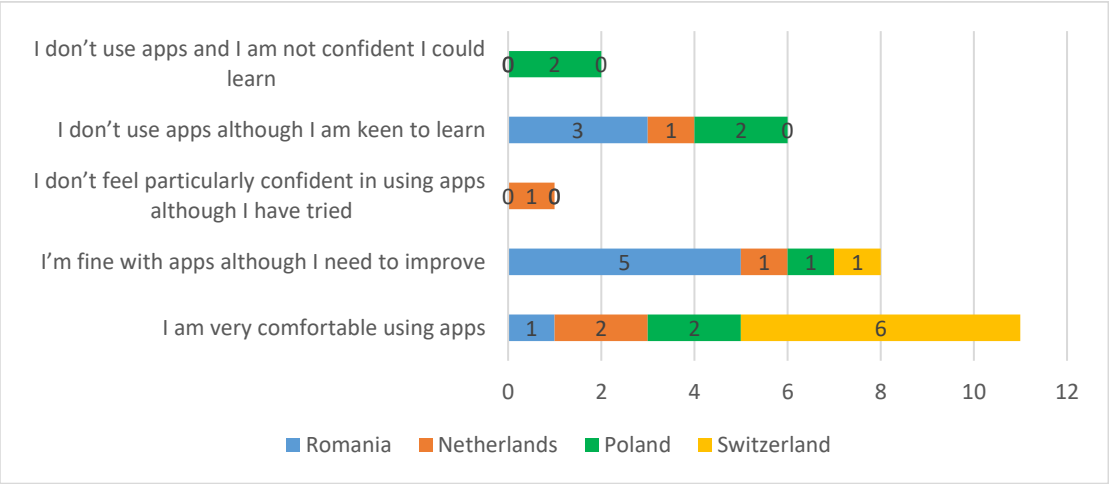

Figure: Elders using apps

Q10. How comfortable are you with using internet platforms?

Participants want to use applications or internet platforms. Some participants from Switzerland and only few persons from other countries declared that they feel very comfortable with using platforms (2 persons in the Netherlands, 2 persons in Poland and 5 persons in Switzerland) and most from Romania declared that they are just fine with platforms and need to improve (5 persons in Romania, 2 persons in Netherlands, 1 person in Poland and 2 persons in Switzerland). Few of the participants from Romania and Poland are ready to learn (3 in Romania and 3 persons in Poland).

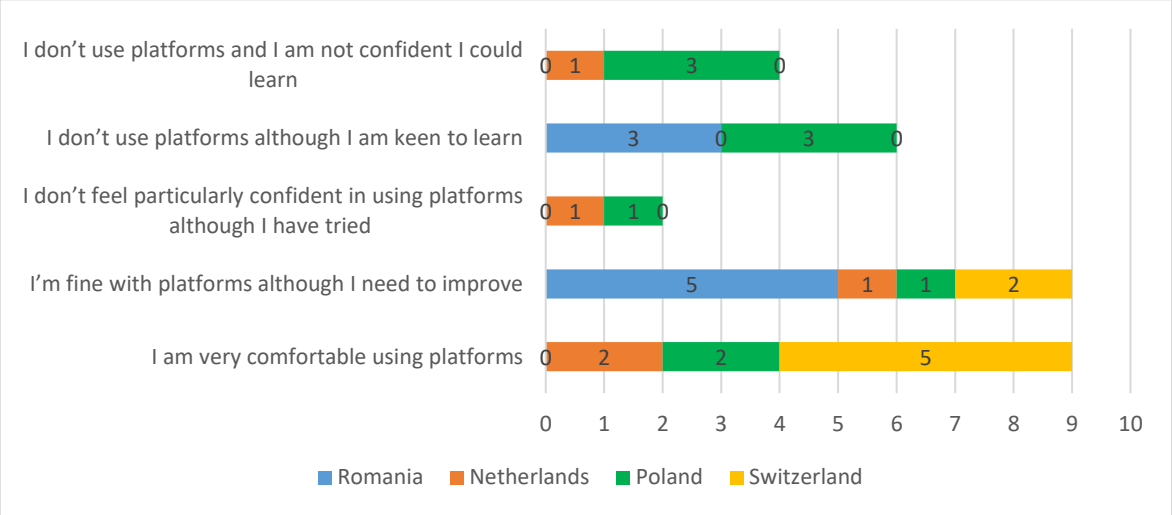

Figure: Elders using internet platforms

Q11. Have you ever been interacting with voice-based virtual assistants and what is your view about them?

Most of the respondents from Romania and Netherlands declared that they never interacted with a virtual assistant but they were keen to try, while only half of the participants from Switzerland and some from Poland showed interest (6 persons in Romania 5 in the Netherlands, 3 in Poland and 4 persons in Switzerland).

Q12. What are the practical barriers that you might perceive would get in the way of you using a solution like Ella4Life plans to provide?

Some persons asserted that preference for classical channels or using technology could be a barrier that prevents using Ella4Life (4 persons in Romania, 4 in Poland and 2 persons in Switzerland). Most of the participants from Netherlands declared that payment for the concept or installing issues might constitute relevant barriers, as said 1 senior in Romania, 5 persons from the Netherlands and 1 person in Poland. Other barriers that were mentioned were difficulties with installing the solution at home (5 persons in the Netherlands) and lack of trust in online transactions (2 persons in Switzerland). The lack of motivation was not a barrier, in the opinion of the elders.

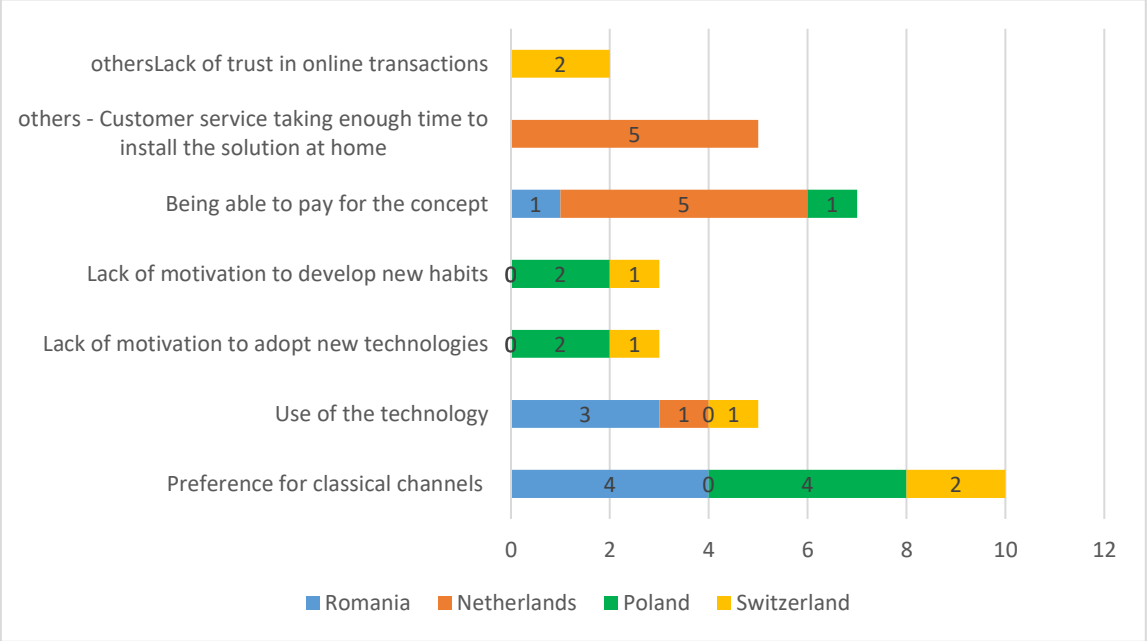

Figure: The practical barriers that you might perceive

5 Conclusions

This report assessed the end-user requirements as an important part of testing the iterative prototypes of Ella4Life. Research on user requirements aims to answer to the following question: *"What do users need the solution to do, and what they want, taking into account their satisfaction?"*

The evaluation was based on qualitative research for understanding human behaviour, such as satisfaction, requirements and opinions. Results will be used for developing the final integrated solution Ella4Life to offer the best product in terms of usability, reliability, efficiency and other relevant features.

By employing tools such as focus group and semi-structured interviews, relevant data for exploring new ideas and development of integrated solution Ella4Life was collected for analysis. The participants into the research were distributed as following: 8 persons from Romania, 7 persons from Poland, 8 persons from Switzerland and 5 persons from the Netherlands. Respondents were over 55 years, male and female, with different levels of knowledge about the mobile and app-based technology or internet platforms. The discussions with end-users revealed significant information about the perception of the use and characteristics of the proposed Ella4Life solution. Nevertheless, we were interested in investigating

people capability to benefit from our integrated solution, in order to develop the right product for helping them.

5.1 Findings from focus-groups

Both the Romanian and the Swiss group understand E4L as being of real help to elders who need support, while the Dutch group share a more preventive approach to the E4L solution, suggesting to be adopted in stages, based on the user's state of frailty. The Romanians suggested to customize the application to the specific needs of each person. All appreciate the support E4L gives for an independent living, except for the group from Poland who look at the solution as being unrealistic.

The cultural characteristics shall be acknowledged and further inquired as the E4L should consider them while designing and marketing the product.

> The Swiss group emphasized the cons specific to technologies: a fixed everyday structure, loneliness, no memory stimulation, consequences of a failing system. The explanation might be three-folded: 1) the Swiss group, aged less than 64 is less in need of such a service, 2) as they still work, they are more exposed to technologies than the other participants, and 3) Switzerland is also home of high-tech global companies and, therefore, people might be more aware of the pros and cons of technologies.
>
> The Romanians are willing to receive more information, medical coverage and connection to others than all the other cultural groups.
>
> The Dutch have a preventive approach and believe in the adoption of the the solution E4L in stages and, therefore, the market strategy should also be based on that (monthly fee, the possiblity of integrating services in stages).

The Romanians and Dutch emphasized that the sensors should be implemented extensively, all over the house and even outside it, increasing the users' sense of security. Other suggestions for improvement were given as well: individual adaptation, voice control accessibility, more diverse information shall be added to the platform, such as professional advices, communication with others, and motivating a positive state of mind.

Price and privacy were mentioned as barriers most frequently, along accessibility.

5.2 Findings from semi-structured interviews

The concept needs to be more clearly presented as only about half of the participants fully understood the concept and one third of the participants stated that they understood the main points of the concept. **Swiss' lack of enthusiasm for adopting Ella4Life** needs to be further investigated. Potential reasons for

their reservation might be: the early age of the participants (6 persons are aged below 56), similar technological solutions, alternatives which make the Ella4Life concept unattractive or other. The understanding of E4L as being unrealistic to participants from Poland needs to be further investigated.

Acceptance to use. There is a large acceptance of using ELLA4Life in Romania and Netherlands.

Interacting with a virtual assistant. Generally, elders think that interacting with a virtual assistant is of benefit to them.
Participants from Romania and Swistzerland expect from the virtual assistant pertinent advice and coaching when needed. People from Swiss and Netherlands believe that a virtual assistant may help seniors to improve their mood when they feel down, while Romanians and Poles do not share the same expectation. Except for the Romanians, majority of the participants believe that the virtual assistant may help them to get in contact with a doctor. Most of the respondents expect virtual assistant to offer useful information in real-time.

Information. Generally, participants appreciate the proposed information received through Ella4Life platform, especially agenda and news, weather info, medication, notifications, and video calling.

More specifically, all people from Netherlands are interested in critical information about medication. Romanians and Dutch are interested in Agenda and News, while all Swiss showed interest in local news (along Poles), music selection and events nearby. If it is not the case of a biased selection, the explanation might be that Swiss group is the youngest one, aged below 64, and their interests and entertainment preferences significanlty differ from those older than 64 and that they also share a regional identity more powerful than the national one.

Self-management practices. Almost all participants consider that the proposed tool for treatment and self-management is important, and the most appreciated are reminders for measuring blood pressure and reminders for taking medicines and online interaction.

Though, some participants expressed anxiety towards the idea of 'total control'. It needs to be further investigated if that is a more common feeling.

Self-monitoring items. Elders agree on the idea of having sensors for monitoring their movement or possible incidents (falls, heart attack, lose consciousness, etc.) because they are aware of their fragility, and sensors offer them a sense of security. Many more respondents need automatic water cut off and water dump if dangerous conditions are detected. Many elders valued the presence of sensors in the armchair as useful in automatic triggering and distribution of alerts. Sensors of the bathtub are appreciated only by the Romanians and the Poles, as other see no use in they do not longer use the bathtub for security reasons.

Privacy and data security are top concerns, and price is seen as a barrier by the majority of the participants.

The research findings increased the understanding of user requirements, attitudes, desires and needs of elders who are the potential users of Ella4Life solution. Overall, the research brings more information for Consortium project who aim to offer the best product by integrating technologies to support elders to live a more quality life.

6 Definitions, Acronyms and Abbreviations

Ella4Life - Acronym of the current project: "Ella4Life – your Virtual Personal Assistant for home and on the road"

AAL Programme - Active Assistive Living Programme

ICT - Information and Communication Technology

7 Appendix

Annex 1: Guidelines for focus group

1. Presentation of Ella4Life

We aimed building a system that combines Anne's strengths with Emma's strengths and employs sensor data. Ella4Life is a modern version of a personal virtual assistant with friendly face talking to the users and interacting with them and showing humans emotions.
Ella4Life integrates 3 technologies and help people particularly in relation with the idea of having a virtual assistant learning personal preferences and habits, monitoring certain health parameters and helping them with adapted suggestions and advice.
More, Ella4Life will enable the elderly
to live independently longer by giving them an easy-to-use, most natural way to interact with assistive technology. It's able to learn autonomously from its users and understand their personal preferences and needs.

2. About the Ella4Life concept and its services

- Do you understand the Ella4Life concept? [If not, the moderator will need to give further explanation]
- What is your view of the Ella4Life idea? (particularly in relation with the idea of having a virtual assistant learning your preferences and habits, monitoring certain health parameters and helping you with adapted suggestions and advices)?
- Regarding the personal virtual assistant - how comfortable are you with the idea of interacting with a non-human assistant?

3. About Anne

- How do you think that having this personal assistant present all the time, reacting to your demands and providing help will be of benefit to you?
- If you would have to prioritize among the information offered, which type of information would you value most and which seems to be least useful for you? Can you suggest other types of information's that might be added to the platform?

4. About Emma

How do you think that having certain health parameters measured and receiving advices through the platform to help you adhere to your therapy and to self-manage your chronic suffering will be of benefit to you?

5. About sensors

- How do you think that the presence of sensors in your bathtub for detecting falls or other possible incidents (heart attack, lose consciousness) when being in the bath alone will be of benefit to you or to more fragile elderly persons?
- How do you think that the presence of electrode-type of sensors in your armchair allowing long time ECG measurements (like Holter systems) and sending the recordings to your doctor through the Ella4Life platform will be of benefit to you, or to more fragile elderly persons?

- What is your current habit of measuring the ECG? How often do you perform this measurement?
- When traveling, would you consider useful to have a safety-feature built-in that notifies your family members (or your formal or informal caregivers) if something happens to you and they could localize you? How useful would such a feature be?

6. About technology

- What is your experience and expertise in relation to the use of mobile and app-based technology?
- How comfortable are you with using apps?
- Have you ever used other voice-based AI virtual assistant for getting information's (e.g. Siri from Apple, Alexa from Amazon, Bixby from Samsung, Google assistant, etc)? What is your view on that? What benefits and what risks do you foresee when using these apps?
- Have you ever used health tracking devices or sensors that give you feedback or communicate through platforms with your healthcare provider? What is your view on that? What benefits and what risks do you foresee when using these solutions?

7. Generally (barriers and other proposals)

- What are the practical barriers that you might perceive would get in the way of you using the Ella4Life platform?
- What factors would stop you from using the solution?
- Do you have any other comments, questions or ideas regarding the Ella4Life solution?

Annex 2: Semi-structured Interview

The following questionnaire should be completed by all participants in the focus group once the discussion has finished. Furthermore, this questionnaire can be shared with other primary end users not present at the focus group meetings:

Q.1 Do you understand the Ella4Life concept?
(Please tick only one)
ð It is clearly articulated and I understand the purpose of the solution
ð I understand the main points of the Ella4Life concept
ð I am not entirely clear in terms of my understanding of the concept

Q.2 What is your view of the Ella4Life idea (particularly in relation to the idea of using a mobile app/web-based solution for the integrated features offered)?
(Please tick only one)
ð I feel comfortable about the Ella4Life idea and would be happy to benefit from such a service
ð I have mixed feelings about the Ella4Life idea and feel I would need more information
ð I am not comfortable about the Ella4Life idea and would not consider it
ð Comments

Q.3 How do you think that interacting with your virtual assistant will be of benefit to you?
(Please tick all that apply)
ð It will offer useful information in real time
ð It will offer pertinent advices and coaching when I need
ð It would help me to improve my mood when I'm feeling down
ð It would help me stay in contact my family members and /or friends
ð It would help getting in contact with my doctor when needed
ð It would not help me in any way
ð Other (Please enumerate and describe)
_____

Q.4 What types of general information / advices would you prefer to see and/or receive through the Ella4Life platform?
(Please tick all that apply)
ð Agenda
ð Medication
ð Notifications (medication, agenda)
ð Video calling
ð News
ð Radio selection
ð Games (Memory, solitaire and puzzle)
ð Media (pictures and video's)
ð Fun and facts
ð Time and date
ð Weather
ð Speech recognition
ð Speech syntheses
ð Other (Please enumerate and describe)
_____

Q.5 Regarding the adherence-to-treatment and self-management coaching tool provided by Ella4Life solution, what features would you consider important and useful?
(Please tick all that apply)
ð Reminders for measuring blood pressure
ð Reminders for taking medicines
ð Weight measurements
ð Online interaction with family members
ð Online interaction with the healthcare provider
ð Easy-to-use planning tool for health-related actions and activities
ð Other (Please give details)
_____

Q.6 Regarding the sensors in the bathtub and in the armchair (for ECG):
(Please tick all that apply)

For bathtub:
ð Monitor the water level and water temperature
ð Automatic water cut off and water dump if dangerous conditions are detected (e.g. high-water level)
ð Monitor activity of a bathing person (e.g. sleeping, falling down)
ð Monitor heart activity – e.g. detect arrhythmias during bathing
ð Automatic triggering and distribution of alerts for accidents during bathing (e.g. assistance required, heart attack, etc.)
For armchair:
ð Collect data about heart rate variability in long period (like Holter systems)
ð Detect heart arrhythmias
ð Automatic triggering and distribution of alerts (e.g. assistance required, heart attack, etc.)
ð Other comments or suggestions (Please give details)
_____

Q.7 Can you think of any other type of service / features that are not included in the Ella4Life platform but might be very useful to have?
ð Please list what you consider that really is useful
_____

Q.8 What is your experience and expertise in relation to the use of mobile and app-based technology?
(Please tick all that apply)
ð I use a smartphone to access apps every day
ð I use a tablet to access apps every day
ð I use a smartwatch to access apps every day
ð I have a smartphone but only use apps occasionally
ð I have a tablet but only use apps occasionally
ð I have a smartwatch but only use apps occasionally
ð I have a smartphone but I only use it for calls and texts
ð I have a tablet but only use it for entertainment (movies, photos, chat, news, etc.)
ð I have a mobile phone but it is not a smartphone
ð I don't own a mobile phone
ð I use a laptop/PC to access platforms/apps occasionally
ð I use a laptop/PC to access platforms/apps occasionally
ð I have a laptop/PC but only use it for entertainment (movies, photos, chat, news, etc.)
ð Other (Please give details)
_____

Q.9 How comfortable are you with using apps?
(Please tick only one)
ð I am very comfortable using apps
ð I'm fine with apps although I need to improve

ð I don't feel particularly confident in using apps although I have tried
ð I don't use apps although I am keen to learn
ð I don't use apps and I am not confident I could learn
ð Other (Please give details)

_____

Q.10 How comfortable are you with using internet platforms?
(Please tick only one)
ð I am very comfortable using platforms
ð I'm fine with platforms although I need to improve
ð I don't feel particularly confident in using platforms although I have tried
ð I don't use platforms although I am keen to learn
ð I don't use platforms and I am not confident I could learn
ð Other (Please give details)

_____

Q.11 Have you ever been interacting with voice-based virtual assistants and what is your view about them?
(Please tick only one)
ð I interact regularly and enjoy it
ð I occasionally interact and enjoy doing it
ð I never interacted but I am keen to try
ð I never interacted and have no interest in trying
ð Other (Please give details)

_____

Q.14 What are the practical barriers that you might perceive would get in the way of you using a solution like Ella4Life plans to provide?
(Please tick all that apply)
ð Preference for classical channels of getting informed and doing purchases
ð Use of the technology
ð Lack of motivation to adopt new technologies
ð Lack of motivation to develop new habits
ð Lack of trust in online transactions
ð Other (Please give details)

_____

Q.15 Do you have any other comments, questions or ideas regarding the Ella4Life solution?
(Please specify here)

_____

Please check your personal data
Your age
ð 55 – 64 years
ð 65 – 74 years
ð 75 and over

Your gender
ð Female
ð Male

What is your health-status (Please tick all that apply)?
ð I am healthy and active
ð I have some health problems
ð I would like to receive additional help in day-to-day activities at home (reminder, notifications, games, online interaction etc.)
ð I would like to have certain health parameters measured and receiving advices (e.g. monitoring heart activity etc.)