PERSONALIZABLE SERVICES FOR SUPPORTING HEALTHY AGEING

User feedback findings and updated requirements
Deliverable D1.3

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This deliverable is confidential / restricted / **public**.

Nature of this deliverable: **Report** / Prototype / Demonstrator / Other

Consortium partners contributing to this deliverable: Poznań Supercomputing and Networking Center (PSNC), Unviersity Hospitals of Geneva (HUG), terzStiftung (TERZ), Sint Jan Berchmans (SJB)

Version/revision: 1.1

Delivery date: 30.06.2021

Versioning:

Version	Date	Organization
1.00	13.08.2021	PSNC, HUG, TERZ, SJB
1.01	27.08.2021	PSNC
1.1	30.06.2022	PSNC

EXECUTIVE SUMMARY

The current document reports tests conducted mid-project on the full design of the system developed within the project. Based on this relevant updates to the technology assumptions were proposed. They were subject of work within workpackages WP2 and WP3.

The core of this report concerns the so called Alpha study of the technology developed by the project. This study took place between February and May 2021 in the conditions of the COVID19 pandemic. The study was conducted in 4 European cities (Poznań-Poland, Geneva-Switzerland, Berlingen-Switzerland and Hamont-Belgium) and was conducted by 4 researchers located in these centers. Participation in the study was voluntary and did not involve any remuneration for its participants.

The Alpha tests resulted in over 20 recommendations for changes in the design and assumptions made in the first phase of the project.

This document contains also a list of recommendations for improvements of the developed prototype to be implemented as part of the potential future product based on the project results. These were found based on research performed in workpackages WP4 (pilot trials) and WP5 (interviews with potential customers).

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1 INTRODUCTION

The current document describes primarily the methodology, results and analysis of the Alpha test of the PELOSHA system. The Alpha test has been planned as one of the studies to be performed with the participation of representatives of the end users (i.e. seniors and their caregivers). The aim of the Alpha study was to test the usability of the user interface at this stage of system development, without using real devices and without using real data. Researchers wanted to find out how end users perceive the system, whether they can use the current version of the interface, whether it is helpful for them, whether they like it and whether they would like to use it when it becomes available.

The study involved:

- 11 seniors, including 7 men and 4 women. Seniors came from Poland (5), Switzerland (5), and Belgium (1). The average age of the respondents was 69 years old, where the youngest participant was 61 years old and the oldest was 85. Nine of them indicated a high school graduate, diploma or the equivalent, and two - some high school, no diploma as the level of their education.
- 10 caregivers, including 8 women and 2 men. Caregivers came from Switzerland (5) and Belgium (5). The average age of the caregiver is 46 years old, where the youngest was 25 years old and the oldest was 68. All caregivers chose high school graduate, diploma or the equivalent as the level of their education (they are all professional caregivers, most of them are nurses).

Section 2 contains information on the …. The results are summarized in Section 3. Section 4 is dedicated to drawing conclusions and recommendations for improvements of the PELOSHA system design for consideration within WP2 and WP3. These were adequately addressed by the developments within these workpackages.

While the core of this document was meant to present the mid-project tests, feedback collected from them and conclusions drawn from it, at the end of the project we added an additional Section 5 containing a list of recommended modifications following the research performed within WP4 and WP5 in the latest phases of the project execution.

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2 STUDY

2.1 METHODS

The study consisted of 2 parts: the first part was an online questionnaire (with open and closed questions) on the *Lime survey* platform. The second part of the study was to perform tasks on an interactive Axure RP mock-up of the user interface prepared in a version for seniors (Assistant application, tablet version) and for caregivers (Caregiver Dashboard, smartphone version). Due to the conditions of the COVID19 pandemic, the study was adapted to the current restrictions in a given country, which is why most of the study was carried out remotely. Participants connected with the researcher using the Google Meet or Zoom application, then they were provided with a link to the mock-up and asked to share the screen of their devices. The questionnaires and mock-ups of the application were in the participants' native languages. The study was qualitative.

2.2 PROCEDURE

The test procedure began with researchers providing all participants with a link to consent to participate in the study, procedure instructions and the questionnaire. Before the research with target participants was started, a pre-test was carried out at each center, which consisted of performing the entire study with one person, to check the functioning of devices (tablets, smartphones), online meeting platform, internet connection and the mock-ups, in order to check if everything is working and to estimate average time for taking such a test. The results of the pre-test were not taken into account in the later analysis. The second part of the test took about 1.5 hours, no major errors were revealed before the actual test.

2.3 ENCOUNTERED PROBLEMS AND LIMITATIONS

It is important to mention that researchers encountered many difficulties both in organising the study and also in conducting it, which occurred independently of them. The biggest obstacle was the limitations of direct contact related to the COVID19 pandemic. Following the assumptions set out in the *Pilot Test Guidelines Protocol and Instruction* (D4.1), the alpha phase was to be carried out face-to-face with the participants, but due to the high risk of infection, and because elderly people are at particular risk, the study was maximally adjusted to the remote form. The alpha phase was to check the reception of the user interface of the application and all its modules quite comprehensively, to give feedback to all its creators. As a result, the study consisted of many questions and elements that were difficult to conduct without direct contact (especially with elderly people, who often do not use electronic devices very regularly and video calls are unusual and more stressful for them). The study turned out to be a bit too burdensome for this group, due to its duration, the fact of confronting certain situations for the first time in life (e.g. using a tablet), the lack of real contact with another person and the fact that, for example, they only had to imagine the use of accompanying PELOSHA devices. There was also a recruitment issue, as not many vaccinated people were available at that time, and care homes imposed huge restrictions on contact between the residents and outsiders.

Polish seniors raised significant doubts about signing consent online with their first and last names, because they wanted to remain anonymous (probably the effect of fear of being judged, distrust of the security of online tools). This was an important reason why recruitment in Poland was the longest - many people refused to participate in the study.

Although the devices were checked earlier and a pre-test was performed, there were also technical problems. There is no free tool that allows conducting an online meeting for more than 1 hour, with the possibility of sharing the screen on a mobile device, in particular, one where you can record the course of the meeting. This tool should also be available as a link in the web browser so that seniors do not have to set up an account on any platform or install software beforehand. Using Google Meet, while sharing the screen from a tablet by a senior, the moderator saw the shared image in a very poor quality. In addition, not every senior has a Google account - if he or she did not have one, he/she could join the meeting by copying its address (which is also a barrier for some older people - they cannot, for example, accurately select and copy the entire address by navigating between tabs in a web browser) or enter the meeting code manually, which was also an inconvenience as these codes consist of many characters of varying case. It is true that the keyboard buttons on the tablet's screen are large, but older people using the tablet for the first time have no experience in typing on a screen, so some respondents began to get nervous if they made a mistake entering the code. Sometimes, the connection was lost for no reason. During one meeting, the connection was broken twice and the participant was kicked out of the meeting - for example, when trying to share the screen, senior's device has restarted. Some signals outside the researcher's control were very distracting to the older participant. An example would be a 'scan' message with a spinning wheel when the tablet connects to the WiFi network at the senior's location. The senior, who was provided with the tablet, had to connect to the WiFi network at his place of residence with the help of the researcher. The elderly person does not switch between different types of networks daily. "Scanning" is only a message from the device that is searching for available WiFi networks, but the senior does not know about it - one of them started to worry about what is happening. The Google Meet user interface on each device (computer, tablet, smartphone) unfortunately looks a bit different. When the researcher asked the senior to press the menu with 3 dots in the upper left corner (and connect via the laptop), the senior did not know what to do, because the options desired by the researcher are located in a completely different place on the tablet (in the bottom right corner of the screen). Unfortunately, the service is also designed in such a way that to display the meeting options on the mobile device, you have to long-press on the screen (and these options hide after about 3 seconds). It is definitely too short a time for the elderly person to figure out what to do. Additionally, in Google Meet we have the same functions on different devices that are hidden under slightly changed names - for example, when the senior was asked to share the screen, this option on the laptop was called "start presentation" and on the tablet - "show screen". The result was that when the researcher asked the senior to press the "start presentation" button, the senior informed the researcher that there was no such button - and it was true.

Therefore, the proper standardization criterion for the study was not respected. Seniors and caregivers performed the test under various conditions, both online and in some cases (if it was possible) face-to-face, assisted by a researcher. The tests were performed on various devices (seniors used mainly tablets, but in 2 cases also laptops). Each of the caregivers used their personal telephone, so they were different models. Participants used different operating systems and different web browsers.

2.4 QUESTIONNAIRE

The questionnaire aimed to collect declarative data on the self-perceived health of the seniors group and the health of seniors as perceived by the caregivers (several questions were also referring to the care and work performed by caregivers). Individual sections and questions about habits in the field of current health indirectly referred to the appropriate modules in the Assistant and Caregiver Dashboard applications. Section A, common to both groups, briefly described the aim of the project and the rules of participation in the study. The questionnaire (section B) included demographic questions (age, gender, education) and then 31 questions for seniors or 25 questions for caregivers. In section C, researchers asked seniors about their

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degree of independence, and researchers asked caregivers whether they deal with care professionally. Section D was the same for all the respondents - we asked about the degree of experience with the technology. In section E, we asked about the perceived satisfaction with health - seniors were asked directly, and caregivers about the perceived health of the people they care for. Similarly, section F concerned the undertaken physical activity from the perspective of the senior and the caregiver. Section G was focused on taking measurements and section H was about sleeping quality. Section I asked about contact and support from the senior's relatives. Section J, intended only for caregivers, focused on a few additional questions related to the work standards of a professional caregiver.

2.5 USER INTERFACE USABILITY TEST SCENARIO

The test scenarios for both groups were carried out in accordance with the procedure described in the *Pilot Test Guidelines Protocol and Instruction* (D4.1). The condition for joining the second part of the study was the completion of the first part (filling in the consent and questionnaire). At the beginning of the meeting, the respondents were reminded that their participation was voluntary and that they could resign from it at any time. Then, the moderator sent the participant a link to the interactive mock-up intended for testing (or displayed it on the screen of the device, if the meeting was held face-to-face). Participants were asked to think aloud, that is, to express out loud their thoughts, feelings, intentions, judgments, questions and doubts and to answer the researcher's questions. The moderator of the study informed participants that there were no right or wrong answers and that it was not the participant who was being assessed, but only the user interface of the system. During the performance of the tasks, the researcher could not prompt or help the respondent in any way. After the participants have confirmed that the rules are understandable to them, the actual phase of researching the usability would begin. Both groups were asked additional questions at different stages of performing the tasks for a more in-depth exploration. Seniors received photographs with sample associated devices printed on cards to better visualize what they will be using. A video presentation of the Physical Fitness module in the national languages of the respondents was also shown to help them imagine the real operation of its features. Below is a description of the procedure for both seniors and caregivers.

We are going to present you a mock-up of the Pelosha application. Mock-up is only a simulation of a real application. It looks as if it works, but it doesn't. Everything is fake there. It is a tool to imagine how it could work in reality, but it's fake. When you click on something, it may show you something different than you are expecting to see.

Please try to pretend that it is a real application and tell us how it should work.

You need to be aware that we are not testing you. You can't make any mistakes here. If you will not complete some tasks, it means that the app simulation has some errors. We want you to tell us about it so that we can make the real application better.

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2.5.1 SCENARIO FOR SENIORS

Initially, researchers allowed users to go through all the steps on their own by asking seniors to comment out loud on what they were doing and thinking. If users skipped any of the steps during this time, the researcher gave them specific tasks to try to complete all of the following:

Imagine that your caregiver recommended this application to you as the best for taking care of your health. You decided to use it <u>together</u>. Your caregiver will see all your health issues.

Today a technical person who'll help you prepare everything to work correctly came to your home. He told you that you have to wear an electronic band on your wrist to measure your health. But he brought some other devices like a tablet, an electronic box, a scale, a blood pressure monitor, and a help button. He installed everything at your home, and now it's time to turn everything on.

We can't bring it to you, of course, but your task is to imagine that there's everything at your home right now and try to pretend that you want to start using it altogether. We want to find out with you what is not correctly prepared yet so the future users could have an easier job.

So what you see now is:

a wristband

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A stay in touch button on your wall

An electronic box

A scale and a blood pressure monitor

A new tablet

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Now it is time to set everything up. You have to turn the tablet on and start using the application. Here's a link. Click it, and start using the application.

1. *Start using this application*
2. *Create your account*
3. *Choose modules that you'd like to use. Tell me why you chose them*
4. *Dashboard: What is this screen for? How can you use it?*
5. *Add a new blood pressure measurement*

Imagine that you've been using this app for a while now. Show me what the values of different modules are and explain how it has changed during the month. Please keep in mind that all data from the mockup is fake. It's presented only for this research.

- *Blood pressure, pulse, weight, temperature: what do you think it can be useful for?*
- *Daily activity, active calories burned: what is your activity goal? When can it be useful to you? How to change it?*
- *Please check air quality in your room and outside*
- *Exercise quality - please tell me, how do you understand performance and other diagrams*
- *Tell me also how you can use the "Stay in touch" module*
- *You've just received a notification - read it. What does it mean? What should you do now?*
- *Try to personalize the Dashboard screen. What values should be presented there as the most important for you?*

Auxiliary questions asked by the researcher:

- *What are you thinking about?*
- *What doesn't work as you wish?*
- *What should you do next?*
- *How do you understand it?*
- *What do you think this is for?*
- *What do you see here?*
- *Why did you choose these modules but not others?*
- *How do you think it'll work?*
- *What do you expect from using this module?*
- *How can it be useful for your health?*
- *What is this screen for?*
- *How can you use it?*
- *What should happen when you push the button?*
- *What else can you do here?*
- *What is your activity goal?*
- *When can it be useful to you?*
- *How to change it?*
- *What is the air outside your home?*
- *Do you consider it a good day for a walk?*

2.5.2 SCENARIO FOR CAREGIVERS

Initially, researchers allowed users to go through all the stages freely on their own, asking caregivers to comment aloud on what they are doing and thinking. If during this, users skip any of the steps, the researcher asked them for specific tasks, so that they will try to complete all the following:

Imagine that you're taking care of the senior and someone recommended you an app to manage better. The senior just started using it, and now it's your turn to sign up and connect with her/him.

1. *Start using this application*
2. *Create your account*
3. *Add a new senior*
4. *What do you see on the "list of seniors" screen?*
5. *What seems the most useful here?*
6. *What should be improved?*
7. *Tell me how Anna Smith's health is? [different name in each country]*
8. *What should she improve?*
9. *How are you going to tell her about it?*
10. *Tell me how Michael Thomas's health changed last month?*
11. *Take a look at his blood pressure, weight, body temperature, pulse*
12. *Take a look at his daily activity and exercise correctness and explain it*
13. *Take a look at his sleeping habits*
14. *Take a look at the air quality in his room and outside the house.*
15. *What should he improve?*
16. *You've just received a notification - read it. What does it mean? What should you do now?*

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3 RESULTS

3.1 RESULTS OF THE QUESTIONNAIRE STUDY

Both groups of respondents answered the questions briefly, laconically - usually with one sentence or single words. The answers to the questions were very general, the participants usually did not characterize the details

3.1.1 SENIORS

All seniors indicated that they use smartphones and computers, 6 of them use tablets and 3 seniors use smartwatches. All seniors use some applications on their mobiles. The most popular of them were default system applications such as calendar and weather, but this group was also active in social media (Facebook, Instagram).

Independency

Almost all seniors live on their own (10 out of 11 people), nine of them indicated that no person is looking after them, and 2 said that their family cares for them. None of them has benefited from any home services. Only one senior indicated that he uses the "system /medical solution helping remain independent" and it is an emergency call application.

Health satisfaction

All seniors are satisfied with their current state of health. Most of them are interested in keeping it at the current level, and 3 people would like to improve it. Next, respondents were asked about what they need to preserve or improve it: seniors most often value an active lifestyle - respondents from all countries indicated physical exercises as important; they are also aware of their body weight. They were also asked what they have been doing so far to maintain or improve their current state of health: several seniors confirmed that they undertake some type of physical activity - gymnastics, Pilates, Nordic walking or are still active in their job. When asked what they considered to be the greatest challenge on the road to good health, the answers were not clear, however, most of them concerned difficulties in regular exercise and diet. Two seniors mentioned more difficult access to medical care due to COVID19.

Physical activity

All the elderly who participated in the study described themselves as physically active. Seniors like various sports from walking (8/11 people), cycling, swimming to skiing and perform them regularly. Seniors like the most not too tiring and simple activities that do not require specialized equipment. Moreover, just taking up physical activity gives them a sense of satisfaction. They also like the possibility to adapt their activity to themselves - depending on the day or how they are feeling. Many of them indicated being outdoors and being in contact with nature as important. The seniors did not indicate any restrictions that would prevent them from taking up regular activity and determined that the possibility of taking up activity regularly or on average 3 times a week would be satisfactory for them.

Taking measurements

Almost all seniors take measurements (10/11 people). They check their weight regularly, but responses to checking blood pressure have been inconsistent: some do it regularly (usually once or several times a month), and some only when they feel worse and do it for self-control. Respondents were asked what other measurements they should take: some admitted they don't know, some mentioned blood tests, urine, cholesterol, prostate, dental check-up.

Sleeping

Seniors did not indicate any problems with sleeping. Two people reported a problem with falling asleep. They also didn't point out anything they wanted to improve on the quality of their sleep.

Support from family and caregivers

Depending on the senior, the respondents visit a doctor or nurse from once a year to 4-6 times a year. In the support of a doctor or nurse, they value most: tips, awareness of the current health conditions and having control. Each respondent has a different frequency of family meetings, but the most common answer was that they keep in touch with their loved ones daily. They are usually satisfied with the frequency of these contacts. Seniors indicated that they do not need much support from their families for their health.

Unfortunately, not all of study participants answered all the questions in the questionnaires, therefore some of the forms were incomplete.

3.1.2 CAREGIVERS

All caregivers who participated in the study were professionals and most of them were nurses. In the technology section, almost everyone indicated that they use smartphones and most of them also use a computer and tablet. The caregivers indicated that among the applications they use, they mainly use communication apps: WhatsApp, Signal, Siilo (for professionals), social media: Facebook, Instagram and health care apps - they use Google Calendar mostly to manage.

Seniors health satisfaction

Caregivers declared that the seniors they deal with are generally satisfied with their current state of health and would like to keep it that way. They would like to remain active and independent, but caregivers sometimes have to encourage them to move more. In their responses, the caregivers emphasized that improving the physical activity of the elderly is very important. The biggest challenges are depending on the individual senior: some of the responses concerned maintaining autonomy, staying at home all the time, deteriorating health, long distances and communication between caregiver and the senior.

Physical activity

According to the caregivers, walking is the most popular form of activity for the people they care for. Most of them have a chance to do it regularly and depending on the condition of an individual, they undertake such activity 2-3 times a week, and some every day.

Taking measurements

Many caregivers did not answer the questions related to the measurements taken by their clients. The obtained answers show that many seniors take measurements such as blood pressure, heart rate, body temperature, body weight, but sometimes it is necessary to control them to check if they are doing it. Most seniors take measurements weekly, based on medical recommendations. Some caregivers believe no additional measurements are needed, others believe seniors should also monitor skin conditions and oxygen saturation.

Sleeping

When asked whether seniors sleep well, caregivers in Geneva answered mostly no, while in Hamont they answered yes. The Swiss caregivers emphasised that the elderly people they care for need a very individual approach in this area.

Support from family and caregivers

Seniors visit a doctor and a nurse regularly, usually a nurse once a week, and a doctor once a month. The worse the patient's health, the more frequent the nurse's visits.

Questions about caregivers work:

The biggest challenges at work include the issues related to keeping the elderly in a good condition at home, maintaining the autonomy of their charges, and having not enough time. Caregivers try to motivate seniors to exercise regularly by explaining to them that this is important for their health. Caregivers talk to and observe their patients regularly, and monitor their health parameters. Half of the nurses check the results together with the senior and half leave it to the senior himself/herself. When asked what other help seniors need, the answers were very varied: first of all, basic care, health control, support in life (in everyday activities), counselling, but also in management. Much depends on whether the seniors have family support or not. If so, they need less help from caregivers, and if not, they need help in almost every aspect - some older people have trouble getting things done, such as checking official mail that they don't understand, for example. Caregivers organize their work in various ways: some of them using a calendar, some with a team, and some on an ongoing basis, from visit to visit. The collected responses show that nurses in Geneva deal with people who are more ill and require more care than caregivers in Hamont.

3.2 User interface test results

3.2.1 Seniors

Creating an account

Some users were confused about what to do in the beginning, but some logged in on their own - generally, no issues arose here. In the login window, some improvements can be made: confirming a successful login and previewing the password when typing.

Choosing modules

The users made their own choices and there was no need for additional explanation. Users understood this screen as making a choice and selecting the functionalities they want to use in the application. The most frequently chosen modules were: health, physical activity, physical fitness.

Setting up modules

There have been no major issues reported in this section, however, many seniors had trouble giving the names of WiFi and WLAN networks as this is not the information they know their way to. Seniors also did not know why they are supposed to give such information. These settings need to be improved to make the whole process of setting up easier.

Night Activity Module

Only 2 participants chose this module. The respondents had a good understanding of how this module works, however, among a few there were some privacy concerns when collecting information on power consumption and whether the module would be well configured to their actual mode of the day. Seniors did not show any particular interest in this functionality, did not delve into its operation, and some interpreted it as an application informing about "sleep quality".

Dashboard content

The view of this screen was not clear for the respondents - some users perceived it as a table summarizing the results from all modules, and some were able to read only single measurements without relating them in the context of a larger view as a whole. That this was the Assistant's main view wasn't obvious to everyone. Seniors seem to take longer to get used to the dashboard to better understand its purpose. They moved on it uncertainly. Swiss respondents paid great attention to details, pointing to errors in the model, incl. on imprecise vocabulary.

Dashboard – changing modules of the main dynamic tiles

The 3-dot menu button expanded the senior to the quick view for the selected 3 modules and participants did not recognize this possibility on their own. It should not be possible to select the same tile twice with information that is already in the preview of some other. Seniors would like to have a quick overview of the latest results of the modules that are most relevant to them: health and active calories - these blocks have been chosen for the main screen to present most often.

Health module

This module was chosen by almost all users. Respondents liked it very much and expressed many positive opinions. Seniors found most valuable the possibility of real checking their blood pressure, pulse, weight, body temperature. Definitely blood pressure and weight diagrams were most useful. Being asked about the way this data is presented to them, users claim that the symbols and structure of this module were legible and did not cause difficulties for the recipients. Two seniors expressed concern about the regularity of adding their measurements, they would also like the health module to have more options, such as, for example, measuring steps.

Adding blood pressure

The majority of seniors did not make it to the screen to add a blood pressure measurement. Only 3 people managed to do so.

Physical Activity (daily calories goal)

Most seniors chose this module during setup. No problems with setting a goal were observed however, there were questions about what the goal of the activity itself is, what it gives, and on what basis it is determined (300, 500, 1000 kcal). However, the seniors forgot about the device attached to this module (wristband). The idea of collecting information about daily activities was appreciated.

Air quality

This module was mostly chosen. It seems the very idea of the device accompanying this module was incomprehensible (probably, because it was hard to imagine without seeing it). Seniors definitely need to be made clear that CO_2 is not the same as the smog level. Seniors indicated that in this module, attention should be paid to using more pronounced colours when the measurement exceeds the normal value.

Staying in touch

Half of the users chose this module. Seniors who chose it, said they did it out of curiosity rather than a real need to receive such support. Dealing with this functionality, users needed more words of explanation of how it works and what exactly it is, so it is worth considering to describe the view of this module. Seniors understood the Stay in touch module on the basis that if they pressed a button at their home, they would just get help in the given area. The choice of possible help was more problematic, the list could be changed to a different selection method. One user praised receiving an in-app confirmation after pressing a physical button in a location. The symbols on the button were understandable. As with the selection of quick view in the dashboard, also here users would like a given help option to be selected only once so that it would not be displayed for selection in the next list view. One visually impaired person (after cataract surgery) noted that the font was too small.

Physical Fitness (Exercise Station)

This module was chosen primarily by Polish seniors - there is no information that any of the Swiss seniors would choose this functionality. Seniors liked the idea of exercises with a trainer and checking the quality of these exercises, but they expressed extremely different opinions about the charts - some did not understand the information presented on them, others assessed the data presentation positively. One person criticized the graphic side presented in the video, claiming that there are much better ones on the market, for example in the form of computer games. There is a serious problem with distinguishing this module from Physical Activity module.

Changing module settings

Two problems were observed that require improvement: the main menu icon is hardly noticeable, the respondents needed help to find the menu on the dashboard. Seniors did not know the difference between module settings and account settings, they did not know what to expect after selecting these options.

General observation

The participants stated that the font was large enough. What they liked the most was the motivational dimension of the application - both in terms of caring for the health and physical activity. The biggest and most frequent problems include:

- understanding the idea of the PELOSHA system and details of how it works for one in a given home. Also, the idea of receiving care in a way that Pelosha offers. The seniors who participated in the study were not convinced that this application was designed for them - or rather for people who require more comprehensive care. If someone does not have a caregiver, he or she may not really understand the idea of PELOSHA
- during the study, users forgot that they had to imagine using devices that accompany several applications. After testing the interface only on the mock-up, the user did not have a complete idea of the entire PELOSHA service
- not distinguishing between Physical Activity and Physical Fitness modules: "physical activity and physical fitness are the same for me"
- difficulty in finding module settings
- difficulty in figuring out how to change a given module on the quick view tile on the dashboard
- the participants often had no intuition in using digital products - the layout, three-dot or hamburger menu and other solutions which are widely used in the design and teach users some similar interactions and behaviours as standard, were not obvious - this could be a general rule for older people, that are not exposed to such an extent to the use of mobile applications and do not have certain habits of use. The 3-dot quick information tiles menu was the most visible and eye-catching element, but users had no intuition how to use it

Notifications - Reminder from a caregiver

The very idea of reminding, for example, about a medical visit was perceived as useful for users, but they were not interested in receiving it from a caregiver, as they were not recipients of care home services.

Notifications - from the Health module

The notifications were clear. Notifications about health parameters that are not within the norm have been rated useful - presenting them one above the other in a list view and showing only the most important information. However, it is not known how seniors would rate receiving push notifications on mobile devices, as we only asked them about the drop-down list of notifications itself and the overall impression of receiving this type of information.

3.2.2 CAREGIVERS

Creating an account

Generally, users had no problem using this feature on his/her own. In a few cases, it was enough to guide the user in the right direction.

Adding senior

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It was easy for users to add a new senior. Caregivers understand that they can send an invitation only to the seniors who have PELOSHA, but in a few cases, they wondered if some seniors have an email address at all.

List of seniors

With regard to the presented list of seniors, the caregivers most often used the phrase: "very clear". One of the respondents said: "it speaks to me, it is perfect for me". However, bad health parameters of seniors turned out to be visually not alarming enough, so it is worth considering making it more eye-catching. Messages/reminders seem to be the most important feature for them. When asked what functionalities should be added, the answer was:

- ability to see if the patient has taken his or her medication when a health problem is detected (nurses from Switzerland emphasized several times that it would be very useful information to know if someone took their medications and what medications seniors is taking)
- being able to ask for repeat measurements (for example, being able to ask a given senior to take his temperature again before a doctor's appointment to check if it is a measurement error or not)
- putting graphs weekly rather than every 10 days

A senior's screen

Caregivers found the graphical layout useful and the way the data is presented very readable. They appreciated having a list of alerts, which allows one to see if there is a recurrence of a health concern (for example, a low pulse frequently). Comments concerned also good font size, design, and the view which caregivers assessed as full of useful information for them - "it's powerful, it's great". Among the less useful features, many nurses stressed that they did not know what to do with the information on CO_2 and temperature in the senior's room. The same applies to the information on physical activity - "this is a task for a physiotherapist, not for me". They didn't understand posture, accuracy and performance in the Physical Fitness module. Weight information should be presented in the form of numbers, not just a graph, where it is difficult to precisely determine the weight in kilograms from a chart. It was also suggested to consider putting the optimal weight for a particular senior. According to the caregivers, it is essential to include:

- information on the medications taken in the senior's profile. It is also important to be sure, who is preparing the pillbox for the senior
- the ability to see charts of all health parameters of the senior, with the dates of the measurements (just marking the month is not enough)
- history of various alerts in a profile of a given senior, to be able to inform the doctor about it
- frequency of urination and bowel movements, whether senior is constipated or not
- pain assessment with scale
- would like detailed/precise figures in addition to averages (e.g. for blood pressure)
- being able to pass on information about a senior with other medical personnel: doctors, ambulance attendants, other nurses and caregivers
- a place for writing own notes

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One person indicated that she would prefer to check the number of senior steps for a given activity in a specific time period rather than kcal (which is a more useful measure for diabetics or for people who care more about gaining weight than losing it, in her opinion). This person indicated as more valuable information about what activity the senior undertook and whether he or she likes it.

Notification from the Health module and Staying in touch module

The notifications particularly caught the attention of users: both their content, frequency and the very essence of this function. In connection with the notifications, caregiver expressed many concerns and questions about the legitimacy of receiving them. In many situations, to find out what is happening to the senior in the event of some kind of doubt, the caregiver prefers to simply call the senior:

"I'll phone him, then it depends on how the man is. Either I'll go and see him, or I'll have to phone him. Yes, it depends on so many variables. Usually, we prefer a visit, to see in what condition. It makes a big difference. Check to see if he has a treatment, see if he has taken it or not. But my first reflex would be to call him."

There were also conflicting comments:

● The text is too long and unnecessary, too much explanation: "I am a nurse, I also know when a blood pressure is too high or too low"
● Add reference standards to know how much more is not normal

However, users approached the test with commitment, it is certain that they imagined the real situation of including the Caregiver Dashboard in their daily work, so they formulated various important comments and concerns:

● the caregivers also expressed the opinion that the scope of possible assistance under the Stay in touch button goes beyond their professional duties, such as help with cleaning
● some caregivers expressed concern that the warmth of human contact in providing care will be lost in this way. Even if it is useful, some caregivers would rather spend time actually seeing people
● concern about liability on holidays, such as weekends, when they receive notifications from the app

Human Enter Reminders

The functionality was assessed generally positive, however, many caregivers thought that to log in to the panel on the website they were redirected to, they had to enter the senior's e-mail address, not their own.

The nurses in Geneva indicated that it is impossible for them to send a notification for each appointment, but they can imagine this for people who are only caregivers of the elderly. Caregivers from Belgium do not mention possible problems. Main comments and suggestions:

● to add a feature to send a reminder (for a caregiver) sometime before the appointment
● have direct access to the senior's calendar
● not understanding the difference between sending a reminder and sending a message
● caregivers did not like the fact that they had to manually type the content of such messages and specified that this would take far too long (almost all caregivers criticize the idea of writing down the message) - they prefer to be able to click on an appointment and set the details

- would like it to be easier to log out of the dashboard and return to the Caregiver Dashboard
- were afraid that each time they wanted to send a notification to a given senior, they would have to log in again

How does a caregiver value the below information about seniors' health?

a) Sending notifications:

Nurses were highly critical of the functionality of sending reminders to seniors about their appointments. Some of them admitted that they would not like to use it and prefer to just call and talk. Concern was also expressed as to whether seniors are so technically proficient as to keep checking the receipt of notifications on their mobile devices - as a possible solution, reading the reminder aloud was suggested.

b) Health measurements:

The nurses found that this module is well designed for its intended purpose, it gives them a general overview of the health status of a senior, but still lack some important information (oxygen saturation level, pain scale, where someone can indicate the level of pain, intestinal transit - if someone went to the toilet, frequency of bowel movements, constipation, diarrhea).

c) Daily activity:

As a feature, daily activity was assessed positively, but the caregivers had difficulty distinguishing between the Physical Fitness and Physical Activity modules from each other, so they proposed to put them in one view (for example, kcal and weight lost), arguing that it was all about movement.

d) Night activity:

Opinions on the Night Activity module were divided. Some nurses were afraid of being disturbed about something happening at night, some considered the functionality itself useful (but without further comment), some had reservations: at what times will the module collect this information? Are they supposed to choose the devices the power consumption of which they are to see? What if someone visits a senior at night and the electricity consumption is higher? Information that would be primarily useful is that someone has fallen during the night and has been unconscious, and for what time - it has been suggested that the wristband should collect such information.

e) Air quality:

The most popular opinion among caregivers was the statement "nice to know, not need to know" about the information they can receive from the Air Quality module. Nurses admitted that they would not know what to do with such information, how they should react, and they did not know what the information on air quality could be of use to.

A group of caregivers, however, intrigued by the solutions provided by the application, expressed the belief that the Caregiver Dashboard was not quite designed for their real needs - as it stands, it could be better for people who are "only caregivers'' but nurses do not perform many of the tasks that were previewed in this version of the app. Hence there was often confusion about what to do with information such as air

quality, a request for help with cleaning, information about high electricity usage at night. Below are some quotes relating to the general views expressed by respondents about the entire PELOSHA system and how the guardian would receive support through the app:

- *"Life and let live. It isn't a hospital, it is your home"*
- *"It is a system that could be of great help in the distant future. Not yet. Our seniors (and their children) are not yet technically skilled to get started with this."*
- *"Above all, I miss the warm hand of care in this system. Yes, it would be relieving, because you no longer have to go every day to measure blood pressure. On the other hand, we are often the only physical contact on a day and that disappears with this system. That's why I wouldn't want to use it."*

4 CONCLUSIONS AND RECOMMENDATIONS FOR IMPROVEMENT FOLLOWING THE ALPHA TEST

4.1 GENERAL CONCLUSIONS

The conducted study was the first comprehensive experience with the PELOSHA system for both the senior group and the caregiver group. The study encountered several difficulties in the realm of participant selection and difficulties during the conduct, especially for older respondents, in the face of the COVID19 pandemic. The collected data made it possible to present the everyday way of life of selected seniors and to better understand the nature of the work of carers, including nurses. This information, both in the declarative form (questionnaire responses) and observations (as part of a practical test on the user interface), will help to better establish the perspective of users on both sides, concerns and expectations of respondents, to better prepare the system in subsequent versions.

Both groups of respondents positively responded to the idea behind the creation of PELOSHA, however, they do not fully feel that they are the right audience. For a fully remote form, the study was probably too extensive and multidimensional, particularly for the senior group. The seniors were unable to maintain a unified focus on so many new stimuli throughout the online meeting: some of them were using a tablet for the first time and connecting with someone via a video chat app. In addition, the uncommonness of the study situation, using each module, viewing the Physical Fitness presentation video, remembering additional devices, answering researcher's questions, which required a lot of concentration, all made the seniors feel tired quickly, and the answers became incomplete after a while.

Recipients perceive the solutions implemented in the system as valuable for future operation, although they also have some reservations as to the specific details of the modules' working (usually because they offer too few options that are interesting for them). The appearance and graphic presentation issues were found attractive in both groups. It can be said that in general, both seniors and caregivers can use the user interface to successfully operate the PELOSHA system. What still needs to be refined are functional issues, that is, how PELOSHA can help one solve specific problems.

Unfortunately, the study participants did not fully understand the formula of the study on interactive mock-ups: although the researchers warned the respondents before starting the procedure that the data that users would see is imaginary, given for presentation purposes only, and that not all interface elements are active and working properly, the respondents often focused attention to these details, not referring to the solutions proposed for the operation of given modules, assessing their suitability in their situation. Many questions (both in the questionnaires and in the observation fields of the mock-up survey) remained empty and there is no information as to why the respondents did not share their observations on certain aspects.

The group of seniors that took part in the Alpha test turned out not to be a very representative group for the PELOSHA system, because the seniors, despite meeting the formal age criteria for selecting the respondents, had no experience of working with the caregiver - all of them lived independently, not taking advantage of any solutions that decrease limitations in independence. Interestingly, the oldest participant in the study (85 years old, Quality management regarding medical products) is still professionally active, which even more indicates that the respondents turned out not to be the perfect recipients for which the Assistant application is designed. The seniors we surveyed are generally still active individuals with a high degree of independence and use of technology.

Based on declarative data, information was collected that seniors are rather satisfied with their current state of health, they also undertake physical activity and it is important for them. They perform

measurements such as checking blood pressure and weight. An important factor for this group is motivating them to undertake physical effort consistently. Therefore, it was difficult for them to imagine themselves as real recipients of the system because, at the time of conducting the research, they did not need any specialist support yet. Certain national differences were noticed: Polish respondents pointed to more difficult access to medical care than elders from other countries. Swiss seniors are more likely to have better devices (most of them use tablets and smartwatches, which is not a particularly common tendency among the elderly) and they are more familiar with using them, but generally, they all use mobile devices as well as applications - and often these are communication applications.

The most popular modules were Health and Physical Activity, and the least popular - Night Activity and Air Quality. The greatest value of the Assistant application was its motivational character, which encouraged people to take care of themselves in an attractive way, putting great emphasis on the dimension of physical activity. Improvements are required by increasing the availability of configuration options in the main menu and considering the easier adjustment of the quick preview of selected modules in the dashboard. However, it is difficult to decide on the basis of this sample alone, if the problems with finding the desired functions on the dashboard would only improve as a result of more frequent exposure to the use of applications, training and learning. Perhaps some application views could just be better described in the form of a short instruction on what needs to be done to take advantage of the functionality.

Certainly, there are still many unresolved doubts that leave caregivers with concerns about the use of the system. The group of caregivers showed significant commitment during both parts of the test, resulting in many valuable insights. Numerous statements regarding specific functions were also valuable, which people professionally involved in caring rated as useful in the challenges they face on a daily basis.

The caregivers usually described the health of their charges as good. They pointed out that it all depends on the patient's individual situation - to what extent he or she is ill or active, whether he/she lives alone or not, whether a person has support from his/her family and another caregiver, some are very independent and do not require support, but some of them have a problem with everyday affairs. Some caregivers were afraid that the solutions proposed by PELOSHA might surpass their charges in terms of technology - they were not sure if each of them had at least an email address and could use it. They confirmed how important it is to try to stay fit and it is one of the biggest challenges they face at work - motivating and explaining to older people that they should undertake some kind of activity. What the caregivers most often found useful was a preview of the list of seniors they care for. The individual preview with a summary of the parameters of each person was also praised. During the study, several inspiring suggestions for improvement were received because caregivers (especially nurses) lacked some information that is crucial for them in their care - the most important information that was missing was the list of medications taken by seniors. The biggest reservations in this group were raised by receiving notifications - their recipients were afraid of being overwhelmed by the number of notifications from all seniors and the fact that they would not have enough time to constantly check the phone to respond to current needs. The Human Entered Reminders module caused the greatest difficulties - the caregivers first of all raised objections that they would not be able to remind the elderly about their appointments on an ongoing basis, so some of them suggested that they should receive an earlier "reminder to send a reminder" - which, however, may generally not pass the basic purpose and assumptions of this functionality.

Despite slightly more enthusiastic reactions to the application than in the seniors' group, caregivers express doubts about caring for another person only using the application on the phone - they openly say that they prefer to call and check what is happening than communicate based on receiving alerts in the system. This fear also directs their thoughts to the fact that seniors often need their care and presence physically, which a technological solution will never provide. What is certain is that caregivers need to have a good

understanding of how it works and to resolve any doubts they may have to be able to use PELOSHA satisfactorily.

4.2 RECOMMENDATIONS FOR IMPROVEMENT

The first contact of both groups of recipients with the product revealed a lot of questions about the real situations of using the applications. Seniors and caregivers currently have an insufficient understanding of the system and the solutions it can provide them in the future. Users should have the opportunity to become better acquainted with the very idea behind PELOSHA and be able to resolve their very specific doubts. The Assistant and Caregiver Dashboard applications should also be developed by both sides of users, to maximize the benefits and satisfaction for all. Understanding of how each of the modules works, and the role of their assisting devices, should be realized before final implementation in the Beta testing phase.

4.2.1 RECOMMENDATIONS FOR THE ASSISTANT APPLICATION

The following are the detailed recommendations for modification of the Assistant:

1. **Ease of logging in.** In the password entry field, there should be an "eye" symbol, after which the senior can see if the entered password is correct before logging in.

2. **Eliminate the need for seniors to provide the name of WiFi and WLAN networks.** If this information is necessary to properly configure the devices with the application, the operation of entering this data should be performed by a technician during the installation.

3. **Including short explanations where necessary.** During configuration, there may be concerns about the privacy and security of data storage, as well as doubts about the purpose of their processing. Seniors, as a group at high risk of falling victim to fraud, are quite distrustful. Giving a reason why a senior needs to enter quite personal information can increase comfort and confidence. PELOSHA is an innovative and unusual solution, so it is not surprising that many people wonder how some of the possibilities work. The placement of e.g. an icon with a little explanatory text, for example in the setup phase, what is the purpose of physical activity, how to use the Stay in touch module, seems appropriate.

4. **Consider placing a settings icon in each module.** The possibility of reaching the settings can be facilitated by adding an alternative path - for example, placing an icon in the corner of the view of a given module that will take you directly to the settings of that particular module to make a quick change.

5. **Improve the vocabulary in German to make it more appropriate.** Words that are misspelt or that do not accurately convey the most accurate meaning should be improved.

6. **Increasing the availability of menu selections:**
   a. main menu - improving the visibility of the button, visually drawing attention to the general priority role played in the management of the Assistant application

b. menu placed on quick view tiles - increasing the suggestion of interactivity of the current 3-dot menu or changing it to another, more readable symbol. Quick view tiles of selected modules play a very important role in the dashboard view and it is mainly these elements that attracted the attention of seniors, therefore the possibility of changing the view must be rethought

7. **Locking the selection of options that have already been selected.** Both in the settings view of the Stay in touch module and when selecting the quick view of the module on the tiles in the dashboard view. If a senior has selected an option in one list, the next option should be invisible and impossible to select.

8. **Colours that correspond more clearly with the content.** In the Air Quality module, the colours should more closely reflect the measurements they relate to - values outside the norm should have a more alarming appearance, for example, on a green and red scale. It should also be resolved that the level of CO_2 is not the level of smog - perhaps, all measurements of air parameters should refer to more real examples, e.g. which means for a senior citizen too high level of CO_2 in the room or too low temperature.

9. **A clearer distinction between Physical Activity and Physical Fitness modules.** The module descriptions that seniors can read when choosing the most needed functionalities are not enough to distinguish them, because both module names indicate some type of physical activity. The distinction can come with the practice of using devices attached to the modules when recipients will already associate that Physical Activity is measurements obtained by wearing a wristband, and Physical Fitness is exercises together with a virtual trainer. It is worth considering adding some verbal explanation in the Physical Activity and Physical Fitness views.

10. **Changing the name of 'account setting', 'module settings' or both.** These names should be a bit more user-friendly and give an older person a better idea of what he/she will find in those views. Perhaps only a minor tweak is needed here, for example, "my settings" and "my modules".

11. **Enhance the motivational character of the entire application.** One of the goals set by PELOSHA is to increase the quality of life of older people. The alpha test not only confirmed that seniors should be fit all the time but also revealed that they really care about doing it. All amenities containing a motivational tone and encouraging to lead a healthy lifestyle will increase the perception of the system as attractive and useful, i.e. one that is worth introducing into your everyday life.

4.2.2 RECOMMENDATIONS FOR THE CAREGIVER DASHBOARD APPLICATION

The following are the detailed recommendations for modification of the Caregiver Dashboard:

1. **Making parameters that are outside the norm more alarming.** Caregivers only need to receive the most important information and should know immediately how to respond to it. These signals should be more clearly highlighted with colours, for example, by highlighting the entire module in

red when a given parameter is disturbing.

2. **Adding the following information to the senior's profile:**
   - a list of currently taken medications (preferably also with an annotation who is preparing the pillbox and whether the senior took the medications on a given day)
   - frequency of urination and bowel movements, whether senior is constipated or not, diarrhoea
   - pain assessment with scale
   - space to take caregiver's own notes
   - oxygen saturation

3. **More precise charts.** The time range should be every week with periods of, for example, 10 days. The weight graph should be accurate to the kilogram, the temperature to the degree, and the pressure to the unit. Next to the graphs, there should also be information about the last measurement with the use of a number, because displaying the average from the last time is insufficient.

4. **Adding measurement dates on module tiles in the senior profile.**

5. **Consider placing information from Physical Activity and Physical Fitness.** Nurses point out that this information is intended for physiotherapists, not for them. Posture, accuracy and performance charts should be more substantive for them - perhaps a different way of informing caregivers about the fact that a given senior was active should be proposed, not necessarily with a detailed chart, but only information that the senior undertook certain activities in a given week or not.

6. **Adding the history of disturbing alerts in the senior's profile.** It would be important to inform a doctor about recurring problems, for example. The history of alerts could be placed at the bottom of the screen in the senior profile.

7. **Possibility to share information about seniors with other medical staff.** Being able to provide information on recent measurements and alarming results would be beneficial in certain situations with doctors, emergency staff, other nurses and caregivers - for example, using a button in the senior profile only to other caregivers who also use PELOSHA or in the form of a file in the email.

8. **One-time login to the Human Entered Reminders panel.** Consider making the steps of creating and sending notifications more automated, including in the form of ready-made blocks such as "medical visit", "visit to the dentist", "diagnostic examination", with the option of manually entering the content of the reminder.

9. **Ease of returning to the Caregiver Dashboard application upon logging out of the notification sending panel.** The recommended solution is that after pressing "log out" in the browser window, caregiver not only leaves this page but also returns to the Human Entered Reminders view in the

application.

10. **Consider whether it is necessary to inform caregivers about the air quality.** Propose more specific solutions concerning the provision of this information - e.g. in the form of clear recommendations or removing this view from the Caregiver Dashboard application.

11. **Settling theoretical doubts about the Night Activity module.** Defining the range of hours within which caregiver is to be notified, who selects the devices for which the power consumption will be measured, and the limit cases that should not be of concern. If possible, caregiver should be informed in some way if the senior has fallen over.

12. **Finding a compromise between extreme opinions regarding the standards of individual parameters.** Given the allegation that there is too much text, the scope of the pressure standard, the weight of others, should be indicated, but in a visual and not text form, e.g. in the form of a legible border on a chart, and not informing about it in the content of the notification.

5 END OF PROJECT RECOMMENDATIONS FOR IMPROVEMENT

Since the feedback collected throughout the project suggests potential in commercialization of the project results, it was of interest for the project consortium to create a list of recommended improvements and modifications of the developed technology. These recommendations are drawn from the research reported in deliverables *D4.2. Pilot trial and evaluation of the system* and *D5.4. Market analysis and business models*, from the feedback collected during beta pilot trials and interviews with respresentatives of the targeted customers.

Core of the platform

For the core of the PELOSHA platform the following recommendations could be drawn:

- adding a mechanism enabling (selected) modules to be functional without the need for seniors and caregivers to use, respectively, tablets and smartphones
- adding a mechanism to Assistant allowing the caregiver (or another authorized user) to act on behalf of a senior
- enabling Caregiver Dashboard as a standalone GUI placed in the duty room of caregivers
- improving notifications in the Caregiver Dashboard, i.e. making them more visible by caregivers
- using the strategy to onboard seniors that does not require them to configure the Assistant by themselves

PELOSHA Modules

To improve the PELOSHA Modules the following updates are encouraged:

- making the Stay in touch button more readable by seniors through bigger and colorful plates
- extending possibility for Stay in touch to pass more messages (more buttons than 4)
- focusing Air Quality on CO_2 levels and changing strategy of notifications related to air temperature
- adding measurement of oxygen saturation as part of Health
- enabling measurements in Health through sole use of medical devices, without the need to touch the Assistant or other user application
- creating a scenario for Night Activity in which caregivers can be notified of the fact of switching on certain devices right away (instant notifications)
- enabling monitoring of devices to relate to multiple users (i.e. changing the relation from one monitored device – one system user to one monitored device – multiple system users)
- considering further evaluation of the exercises used within Training and testing them with seniors more extensively
- abandoning Reminders as part of the PELOSHA offer or redeveloping it in such a way that reminders are not entered manually by caregivers, but are read automatically from other systems