

**AAL Project****Indoor and outdoor NITICSplus solution for dementia challenges****WP1: End-user analysis and design of service concepts****D1.2: Multinational survey****Contractual Date of Delivery to the AAL CMU:** M10**Actual Date of Delivery to the AAL CMU:** M14**Participant(s):** WUT, EXYS, CITST, UPB, IZRIIS, ASLO, DGW, BZN, ASH, SOFTIC**Author(s):** Jerzy Kolakowski, David Krivec, Katarzyna Broczek, Jaouhar Ayadi, Oana Cramariuc, Neja Samar-Brencic, Denes Perenyi, Laszlo Arvai, Eszter Lena Matis, Zsuzsanna Nagymáté, Angelo Consoli**Nature:** R (P-prototype, R-report, O-other)**Dissemination:** Public**Version:** 2.0**Total number of pages:** 56**Abstract:**

*The report describes the results of the multinational survey carried out within task 1.2 (work package 1). It starts with a general description of the research and a presentation of the research guidelines, designed questionnaires and ethical issues. The performance of the survey in particular countries is briefly described. The results of collected data analysis is the main part of the report. The statistics concerning living conditions, caregiving status and technology acceptance, socialization activities, health status and evaluation of the proposed IONIS functionalities are included. Special attention was paid to investigation of cognitive impairment advancement impact on the acceptance of technologies proposed in the IONIS solution. The last section contains a description of the developed personas. The respondent and caregiver questionnaires are included in report's annexes.*

**Keyword list:** AAL, personas, geriatric assessment

## Executive Summary

The aim of the multinational survey was to extend the analysis performed in T1.1 and to bring quantitative answers to the addressed issues. The survey was carried out in four countries: Hungary, Poland, Romania and Slovenia. A total number of 121 primary (elderly) and 103 secondary (caregivers) users filled the dedicated questionnaires. There were no restrictions (e.g. gender, age, living conditions) imposed during the selection of the users. The only criterion for user eligibility was the score in the MMSE test (Mini Mental State Examination) which is indicative of the mental status of the person undergoing the test. Our own criterion for inclusion of the primary users was a MMSE score in the range 19-27 points, which indicates mild cognitive impairment or mild dementia.

The questionnaires were focused on data useful for services design, implementation and testing. The respondents were asked about their living conditions, caregiving status and technology acceptance, which are important factors for the pilots planned in the future. They gave information on their socialization activities and expectations as well as health status. It allows to identify end users' needs and will be helpful in pilots results interpretation. The respondents were also asked about acceptance of the proposed IONIS services and the financial costs of the IONIS solutions.

Collected data were processed with the developed dedicated software. The survey results have shown that although the primary users are generally not acquainted with the ICT solutions, the majority of them perceives the proposed IONIS services as useful. Attitude to technology depends on the cognitive impairment advancement, therefore two groups of the primary users were defined: the people with mild dementia and the people suffering from mild cognitive impairment. The future pilots will be carried out with persons belonging to both groups.

The collected data allowed also for elaboration of personas describing typical IONIS primary users. All primary users that took part in the survey were assigned to four clusters (using kMeans algorithm). Attributes of calculated centroids correspond to personas features. Due to larger number of participants that took part in the survey (in comparison with research performed in Task 1.1) obtained results are more representative.

The deliverable includes presentation of multinational survey results and their analysis. Section 2 is dedicated to the general description of research. It presents research guidelines followed by description of designed questionnaires and ethical issues. Next section contains short reports on research carried out in particular countries. The largest section 4 presents processed survey results. Its structure corresponds to questionnaires content. Special attention was paid to investigation of cognitive impairment advancement impact on the acceptance of technologies proposed in IONIS solution. Section 5 contains description of developed personas.

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## Abbreviations

AAL	Active Assisted Living
ADL	Activities of Daily Living
CMU	Central Management Unit
DoW	Description of Work
EC	European Commission
EU	European Union
GA	General Assembly
GDS	Geriatric Depression Scale
IADL	Instrumental Activities of Daily Living
JP	Joint Programme
ICT	Information and Communication Technologies
IONIS	Indoor and outdoor NITICSplus solution for dementia challenges
MCI	Mild Cognitive Impairment
MMSE	Mini Mental State Examination
PC	Project Coordinator
PDF	Portable Document Format
PwD	Person with Dementia
WP	Work Package

# 1 Introduction

The Work Package 1 of the Indoor and outdoor NITICSplus solution for dementia challenges (IONIS) project aims at the definition of the intended system requirements and service concepts by considering end-users specific needs and requirements with respect to the project goals.

In the Task T1.1, “Task 1.1 Understanding and identifying end-users needs and acceptance of ICT through analytical methods”, the IONIS consortium investigated the delimitation of respondents’ classification rules according to the project activities description where the envisaged platform targeted group are people with mild cognitive impairment or mild dementia. To reach this target, MMSE (Mini–Mental State Examination) test score was used as a qualification criterion and questionnaire surveys followed by a shadowing session for the respondent and the caregiver. The covered issues included: subjective memory impairment, self-rated health, independence in everyday tasks performed home and outdoors, sleep problems, the use of electronic equipment and readiness to use ICT within the IONIS project. Both questionnaires had the similar structure. The aim of the survey was to compare the information gathered from the respondent and the carer, especially concerning subjective issues, such as perceived memory impairment, sleep problems and daily performance and by providing a list of activities, respondents assessed perceived problems with activities at home and outdoors. As such, the research activities that were performed in task 1.1 allowed for an initial delimitation of primary-users characteristics and their requirements and the generated personas described the target users of IONIS platform.

The Task 1.2 “Designing and carrying out a multinational survey” followed on the activities that were performed in Task T1.1 and focused on the extension of the analysis that was conducted in it by a multinational survey whose aim is investigate quantitative answers (statistical analysis) to the addressed issues. As specified in the Description Of Work (DOW) of the IONIS project, the surveys were executed in the four end-user countries of the consortium: Poland, Slovenia, Romania and Hungary by the consortium end-user partners: DGW, IZRIIS/ASLO, CITST and ASH, respectively. The initial target of such surveys was a 20-40 primary users per country. Each questionnaire that was presented to each interviewed caretaker was replicated by an interview with the person with MCI or dementia. Equal weight were given when analyzing data for the two types of users. All questions were kept as simple. The structured interviews were prepared jointly by the end-user organizations. Statistical analysis on the collected data highlighted the user requirements regarding the features of the IONIS implementation. These will serve as guidelines in the intended project development by also considering the technological and financial feasibility identified in WP2.

DGW, as the most knowledgeable partner of the geriatric aspects, led the design and implementation of the profiling activities and the survey. The ethical issues that needed to be taken into account in the surveys design were supervised and coordinated by ASLO.



## 2 Research scope

### 2.1 Research guidelines

Research guidelines were formulated to enhance coordinated execution of the survey in all of the participating countries. The document outlined subsequent steps to be taken in the framework of the research. Questionnaires for Respondents and Caregivers were developed in English and, after consultation with all IONIS partners, they were translated into national languages by members of IONIS teams in participating countries.

The aim of the survey is to extend the analysis performed in T1.1 by a multinational survey which will bring quantitative answers (statistical analysis) to the addressed issues.

#### Survey vocabulary

- Primary user = **Respondent** – an older person who fulfils the inclusion criteria;
- Secondary user = **Caregiver** – a carer of the primary user. The caregiver might be an informal one, e.g. a family member, a friend or a formal one – a worker of the social support agency, a carer in a nursing home;
- **Interviewer** = Researcher – a IONIS Consortium member conducting the research
- **Respondent's questionnaire** – a questionnaire filled in by the primary user;
- **Caregiver's questionnaire** - a questionnaire filled in by the secondary user.

#### According to the T1.2 description in the IONIS project proposal:

- The survey should be performed with 20-40 primary users per country,
- Primary user should fulfill qualification criteria (MMSE score between 19 and 27),
- The questionnaires should be presented to caregivers and primary users,
- The primary user should be given enough time to think about questions.

#### Justification of the applied methodology

According to the IONIS project proposal, ICT solutions are intended for older persons with mild cognitive impairment or mild dementia. These people have memory problems and difficulties in learning new complicated tasks, but may function efficiently in a known environment and use simple equipment. The above groups of users are likely to benefit most from the proposed solutions. To identify these potential users, it is necessary to perform a screening test of cognitive functions. The Mini-Mental State Examination (MMSE) test is relatively simple to perform, not time consuming and sensitive enough to validate patients for the purpose of the IONIS study. However, in clinical setting, it would be necessary to perform more sophisticated diagnostic procedures to reveal the cause underlying cognitive impairment. On the other hand, inclusion to the study based on subjective memory problems without performing the MMSE would not be a reliable method. Many older individuals express memory decline without any objective cognitive impairment, while a significant number of dementia patients are unaware of their cognitive decline. Erroneous inclusion of such end-users would result in unneeded ICT support of healthy individuals and inappropriate solutions for people suffering from more advanced stages of dementia who require daily support from other people. Therefore, it is necessary to classify potential end-users using cognitive screening tool such as MMSE.

#### The research comprises the following activities:

1. The purpose of the research should be thoroughly explained to the Respondent and her/his caregiver. Appropriate informed consents should be signed by the Respondent and the Caregiver.
2. The code should be assigned to the questionnaire. The code structure is as follows:

**PPP - T - N - DATE**

where:

**PPP** - code of IONIS partner performing test (e.g. DGW, WUT),

**T** - person role C- Caregiver, R - Respondent

**N** - interviewed Respondent ordinal number 1 ... 20-40 (the Caregiver has the same ordinal number as his/her Respondent)

**DATE** - interview date in format ddmmyyyy ( e.g. 01.04.2018)

3. The Caregiver will be asked to fill in the Caregiver's questionnaire (the questionnaire may be given to the Caregiver and the Caregiver may be asked to return it in a few days).
4. Respondent's survey will be performed during two meetings. To conduct the survey the following inclusion criteria should be met:
  - MMSE test score should be in the range from 19 to 27 points;
  - informed consent is signed;
  - the Respondent is willing to cooperate;
  - the Respondent has no problems with hearing or vision significantly impairing communication;
  - the Respondent does not receive psychoactive drugs (e.g. antipsychotics, benzodiazepines).

At the beginning of the first meeting, the MMSE test should be performed. If the score is in the required range indicating mild cognitive impairment or mild dementia (MMSE 19-27 points), ADL and IADL scales should be conducted. Next, the person will be given the Respondent's questionnaire and informed that she/he has a few days to think about the questions and to give the answers. The respondent's questionnaire should be printed with a large font (at least 14 points).

During the second meeting, the researcher will collect the filled questionnaire. The researcher will check the completeness and coherency of Respondent's answers. In case of problems with filling or understanding the questions by the Respondent, the researcher should read them aloud, explain the questions and mark given answers. The survey can be interrupted at every moment to give the Respondent time to rest.

The Caregiver may help the Respondent to fill in the questionnaire.

If the Respondent has doubts about having the diagnosis of health problems listed in part 4.2., the interviewer may help by listing the following:

- Cardiovascular system disease: arterial hypertension, ischemic heart disease of coronary artery disease, heart failure, atrial fibrillation;
  - Diabetes: may be treated with diet, oral hypoglycemic medication or insulin;
  - Pulmonary disease: chronic obstructive pulmonary disease (COPD), asthma;
  - Nervous system disease: Parkinson's disease, epilepsy;
  - Musculoskeletal system disease: osteoporosis, arthritis (e.g. gonarthritis, coxarthritis), spine degenerative disease;
  - Dizziness: a unpleasant feeling of head movement affecting balance and posture and augmenting the risk of falls.
5. After completing the questionnaire by the Respondent and the Caregiver, the researcher should additionally fill in the "Questionnaire part to be filled by the interviewer" (on the last page of the questionnaire).
  6. After the research is completed, results from both questionnaires (Respondent's and Caregiver's questionnaires) should be transferred to especially designed result forms.

## 2.2 Respondent and caregiver questionnaires

The aim of this multinational research was to conduct a survey based on unanimous questionnaires among Respondents with cognitive impairment and their caregivers, if available. The scope of the survey included characteristics of the potential users of the IONIS platform and their willingness to accept proposed technological solutions. The questions covered the following issues: living arrangements, impairments, caregiving status, health status, social relations, IONIS platform functions acceptance, technology acceptance and tolerable cost of services. The survey was conducted by end-user organizations in Hungary, Poland, Romania and Slovenia. Questionnaires for primary users (Respondents) and their Caregivers were unanimous. It allowed for comparison and verification of the given answers. Both questionnaires are included in Annexes 7.1 and 7.2.

## 2.3 Ethical issues

The words used to talk about dementia can have a significant impact on how people with dementia are viewed and treated in our community. The words used in speech and in writing can influence others' mood, self-esteem, and feelings of happiness or depression. A casual misuse of words or the use of words with negative connotations when talking about dementia in everyday conversations can have a profound impact on the person with dementia as well as on their family and friends. It can also influence how others think about dementia and increase the likelihood of a person with dementia experiencing stigma or discrimination. Appropriate language used by the researchers must be:

- Accurate
- Respectful
- Inclusive
- Empowering
- Non stigmatising

It is important to know that 'dementia' describes a collection of symptoms that are caused by disorders affecting the brain. It is not one specific disease. The following terms/phrases are preferred when talking about dementia:

- Dementia
- Alzheimer's disease and other forms of dementia
- A form of dementia
- A type of dementia
- Symptoms of dementia
- A person/people with dementia
- A person/people living with dementia

The following terms/phrases should not be used:

- Dementing illness
- Demented (person)
- Affliction
- Senile dementia
- Senility
- Sufferer
- Victim

It is important the researchers realize not everyone will like to be referred to as a carer or care-giver. If possible, ask what the person's preference is before using this term. In this context the terms apply to someone that is providing unpaid care to a person with dementia, which is different to a professional or paid carer.

In communication, researchers should remember that while there are some symptoms of dementia that will be experienced by most people to some degree, the nature and severity of symptoms can also be very different for each person, and symptoms are likely to change over time. It is advised to describe the symptom itself e.g. memory loss, change in mood or behaviour, word finding problems and describe the impact it is having e.g. difficulty communicating.

In order to avoid confusion about what is the scope of the study, researchers should:

- ensure that potential participants understand the performed MMSE tests are used only as an inclusion criteria and are not in any case valid as a diagnostic tool;
- ensure that the person understands that he or she does not have to take part in this IONIS study in order to gain clarification about his/her cognitive health (e.g. if he or she already has some concerns),
- explain that what is currently being proposed is participation in the study which in some cases will result in inclusion in IONIS pilots;
- ensure that the person understands that he or she does can refuse to answer or stop participating in this IONIS study at any time.

Researchers should try to ensure that the information resulting from the assessment of inclusion criteria is not disclosed with the participant as it may result in some people experiencing unnecessary distress (i.e. being upset about having a condition which they in fact don't have). To avoid harm and promote wellbeing, researchers should be attentive to how participants make sense of information about cognitive capabilities that is communicated throughout the IONIS project so that it does not fuel existing fears about dementia.

## 3 Research activities

### 3.1 Research in Poland

Respondents for the part of the multinational survey conducted in Poland were chosen carefully from the patients of the Geriatric Outpatient Clinic and the Department of Internal Medicine and Cardiology in the Infant Jesus Clinical Hospital in Warsaw and one nursing home. The patients were assessed with the Mini-Mental State Examination (MMSE), and those with MMSE score of 19-27 (mild cognitive impairment or mild dementia) received the proposal to be included in the survey. If the respondents had caregivers living with them or visiting them on regular bases, the caregivers were also encouraged to take part in the survey. However, people living alone and not having caregivers were not excluded from the survey if they fulfilled cognitive status requirements. The Polish IONIS research team dedicated efforts to choose respondents with fair or good functional performance in order to resemble characteristics of potential future clients of IONIS solutions. All of the respondents and their caregivers signed an informed consent and were thoroughly informed about the European law concerning protection of data. In conclusion, 20 respondents with mild cognitive impairment or mild dementia as well as 13 caregivers were included in the survey in Poland. The survey was conducted in the outpatient clinic, in the hospital ward or in the homes of the respondents and in one nursing home. Among respondents, four were residents of the nursing home and 16 lived in their own homes. The age of the respondents was between 68 and 92 years. The survey was conducted between July and November 2018.

### 3.2 Research in Slovenia

#### 3.2.1 IZRIIS

Users were carefully selected among the existing infrastructure of elderly persons 68 years old or older. 42 users in the wider area of Ljubljana – Central Slovenian Region and Upper Slovenia region (Gorenjska – Kranj) and Primorska region (Koper and Izola) were interviewed for the selection and for meeting of the criteria.

The interviews with end users started in July 2018. In the starting step of the research IZRIIS selected the participants that fulfilled the inclusion criteria set for the participation of the research. We have interviewed 42 end users and based on the selection criteria selected 26 end users and 26 of their carers for the full interview. Average age of the participants was 77 years. The youngest participant was 86 years old, the oldest one was 85 years old. Some of the end-users were also involved in the previous surveys or research in Slovenia.

Out of 26, on the MMSE average scored between 19 and 27 and 1 was selected despite the 28 points since (1) the persons comment that it is not common (she would forget numbers but not words) (2) we compared that result with the GDS in which considerably differ from other persons towards the lower end of the scale (depression); (3) this person also reflected on general to consider her cognitive functions to be much worse in the last 5 years and gradually decreasing – but not so rapidly in the last year.

The primary and secondary end users commented that the research was useful for them to reflect on their situation. It was useful to talk to a professional staff about the project and the related subjects; similar to the previous and ongoing involvement in the IONIS working group of end-users. It was important to them that the research was confidential; in general they considered that the research was not disturbing in any way and welcomed the survey. We anticipate a positive response to further research and involvement due to the ongoing connection to the IZRIIS network of end-users.

#### 3.2.2 Spominčica - Alzheimer Slovenija

In the process of translating the questionnaire in Slovenian language, Spominčica - Alzheimer Slovenija has verified if all included texts and questions are comprehensive, are written in a dementia friendly language and address the needs of the research, we conducted a short pilot test among care professionals and our volunteers. For the selection of user, participants in Multinational study, we have collaborated with Slovenian Working Group of People with Dementia, Spominčica association members, users of our activities and support groups of the Association of Societies for Social Gerontology of Slovenia. Target group consisted of persons with mild cognitive impairment, persons with mild and moderate stage of dementia and their carers.

The interviews with end users started in July 2018. In the first part we have checked if participant fulfills the inclusion criteria set for the participation of the research. We have interviewed 32 end users and based on

the selection criteria selected 20 end users and their carers for the full interview. Average age of participants was 74 years. The youngest participant was 63 years old, the oldest one was 82 years old. We have finished with all interviews in October 2018. The interviews were very intense for the end users and needed the presence of the interviewer to facilitate the progress. The end users and the caregivers were very interested about the results of the project although some of them expressed concerns regarding their ability to use such system in everyday life. They took the time to provide relevant information and agreed that they should have an insight on the course of research.

### 3.3 Research in Romania

End-users were selected from the network of users built by CITST during their participation in previous AAL projects, i.e. NITICS and CAMI. Only elderly end-users from Bucharest (location of CITST) were considered for the survey. The reason for this was that the survey for these users has involved more than one face-to-face session. The end-users already involved in Task 1.1 were approached first. Other end-users were contacted either through direct phone calls or through their relatives or informal caregivers. Users were contacted gradually over the entire length of performing the survey. There were several reasons for this approach:

- Performing the questionnaire was a relatively lengthy task and took several visits to the respondent's home with each visit extending from one to couple of hours.
- The criterion of scoring 19-27 at the MMSE test needed to be verified first. Thus, we were not able to tell how many users out of the ones agreeing to the survey were eligible for the study.
- Summer holidays were complicating things on both ends. On one hand, elderly users were not available and on the other hand the personnel at CITST was reduced.

A total of 29 elderly users agreed to participate in the survey and were included in the initial interviews and MMSE tests. Out of these 20 were selected for the survey based on the MMSE scores. Their informal caregivers were also included in the survey. It turned out that not all elderly had a caregiver (generally those with higher MMSE scores) or that some elderly couples had the same caregiver. These resulted in a number of 15 caregivers involved in the survey. The caregivers often chose to perform the survey alone, when they had more time, and deliver the paper answer to the interviewing person.

### 3.4 Research in Hungary

In Hungary a total of 36 respondents and 32 caregivers questionnaire were completed.

Ultimately, 30 people with cognitive impairment and their caregivers participated in the survey from the Autumn Sunshine Home, and there were 6 more persons (and 2 of their caregivers) independent from ASH were inquired with questionnaire. The independents live in their own flats or houses. These 6 persons were asked in October and at the beginning of November.

The survey in the Autumn Sunshine Home was implemented as follows:

The preparation of the ASH residents regarding the survey and the program itself began much more earlier. The Respondents were informed in detail about the research and its importance and were also informed that the response was voluntary. The questionnaires were answered by people with mild or moderate stage of dementia (with MMSE scores between 19 and 27).

Respondents were informed about their participating and all of them signed the informed consent to take part in the research and fill the questionnaire. Questionnaires were conducted with the help of 5 caretakers who were familiar with the Respondents so the job was done with complete confidence. The questionnaires were taken to the Respondents a few days before, so they had the opportunity to get acquainted with the given questions. Survey was made in the residents' living rooms, in the customary surroundings of the room, so no disturbing circumstances occurred.

According to the feedback from the caregivers, the questionnaires were filled in a good mood, and the inappropriate interpretation of the questions of the survey was minimal.

The caregivers of ASH have also gained new and useful history of the issues what they can use in their daily work, in their own work.

Unfortunately, because of some misunderstandings, the Caregivers' questionnaire query had to be repeated in September. It took some more time and the data re-recording as well.

Outside the ASH 16 potential dement persons were visited in Miskolc (a town in Hungary) and in the countryside.

At the beginning of each visit, MMSE test was completed and the questionnaire survey was only done with the dement person whose score was between 19 and 27.

Firstly they gave their agreement and signed the informed consent.

All in all, 36 respondents and 32 caregivers have filled in the questionnaires.

The youngest dement participants was 56 years old, the eldest one was 96, and 79,8 on average.

10 male and 26 female persons with cognitive impairment took part in the WP 1.2 survey.

Unfortunately, since they live in an elderly home several questions were not relevant for the Respondents living in the ASH and nor for their Caregivers.



## 4 Research results analysis

### 4.1 Introduction

The survey was carried out in four countries: Hungary, Poland, Romania and Slovenia. A total number of 121 primary (elderly) and 103 secondary (caregivers) users filled dedicated questionnaires. There were no restrictions (e.g. gender, age, living conditions) imposed during the selection of the users. The only criterion for user eligibility was the score in the MMSE test (Mini Mental State Examination) which is indicative of the mental status of the person undergoing the test. Our own criterion for inclusion of the primary users was a MMSE score in the range 19-27 points, which indicates mild cognitive impairment or mild dementia. Distribution of respondents and caregivers between countries is shown in Figure 1.

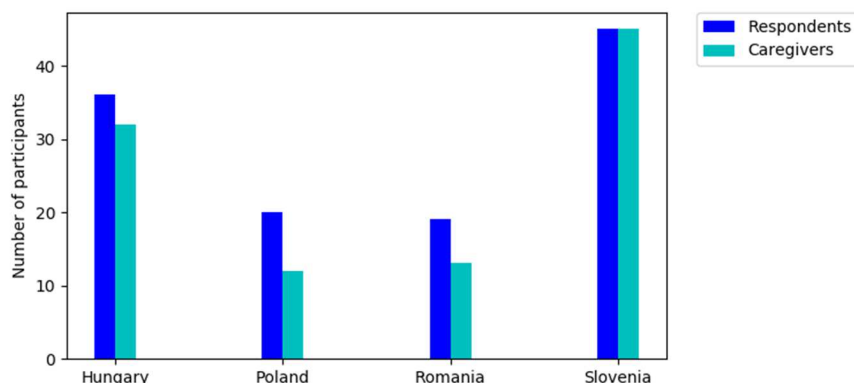


Figure 1: Survey participants in particular countries

The answers given by the Respondents were compared with the Caregiver's answers. They differ in 8.6% cases. The majority of differences can be found in the answers to questions dealing with numbers and time (e.g. flat area, time of going to sleep or waking up, items the Respondent often looks for etc.). Therefore data obtained from such questions were treated as not reliable.

### 4.2 Survey results analysis

#### 4.2.1 Survey respondents

The Respondents, that took part in the survey were aged from 63 to 96 (Figure 2). The group was dominated by women (63 %)

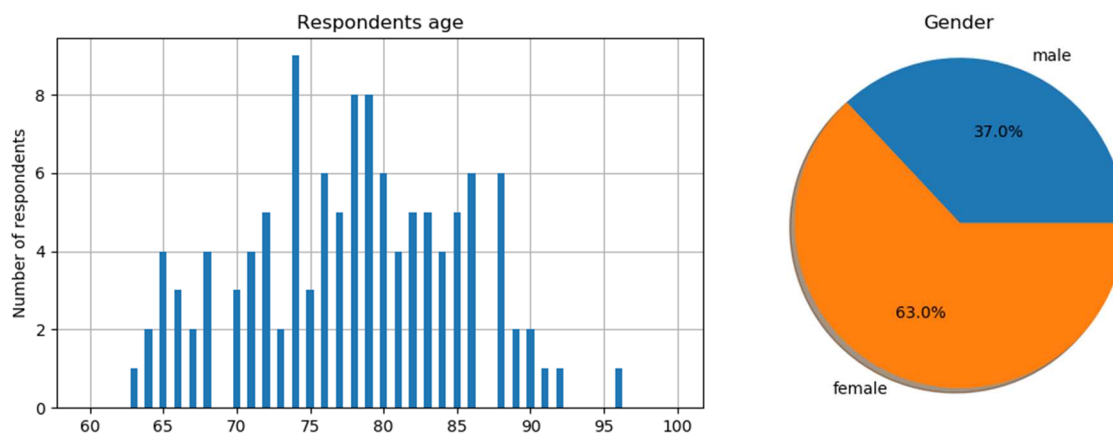
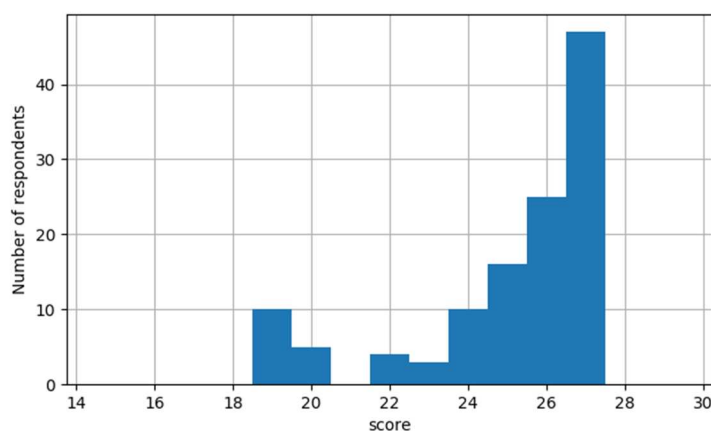


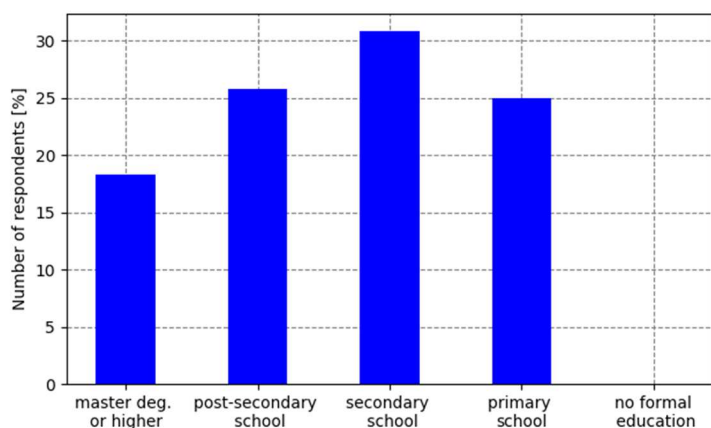
Figure 2: Respondents age and gender

All of the Respondents underwent MMSE test prior to handing them the questionnaires. To comply with user selection criteria, only the persons whose score in the range 19-27 points were surveyed. Distribution of Respondents MMSE scores is shown in figure 3.



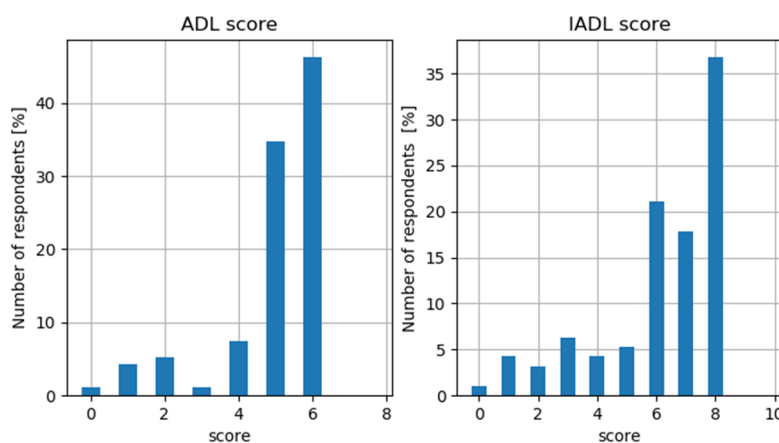
**Figure 3: MMSE score distribution**

Education of the Respondents seems to be one of factors influencing acceptance and ability to use technology. In case of surveyed group more than 44% of people have at least completed post secondary school (Figure 4). Only 25% discontinued their education after graduation from primary school.



**Figure 4: Respondents education**

During sessions, the Respondents participated in two another tests: IADL and ADL estimating their ability to cope with everyday activities. Distributions of obtained results are shown in Figure 5.



**Figure 5: ADL and IADL scores**



## 4.2.2 Living arrangements

Information on living arrangements is important from system services and system deployment point of view. According to the survey, the majority of Respondents live in flats or houses (Figure 6). About 28% of them stay in nursing homes.

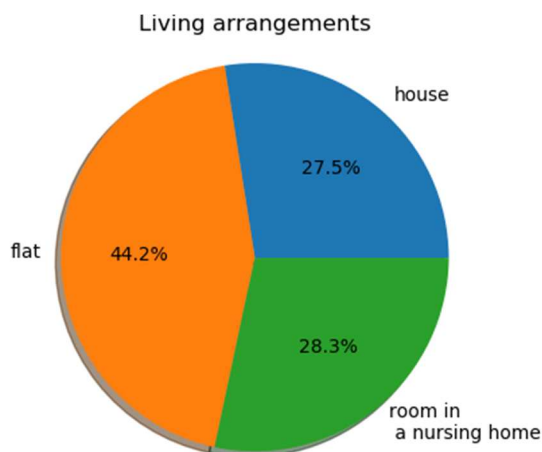


Figure 6: Place of living

Living conditions in flats and houses seem to be good. Majority of Respondents have at least one room at their disposal. Most of their rooms are located at floors lower than the 5th (Figure 7), but close to one third of the Respondents (25 persons) have access to an elevator. That means that some of them have to walk the stairs even to the third floor. Almost 60 percent of the Respondents living in houses or flats have access to a garden or a backyard (Figure 8).

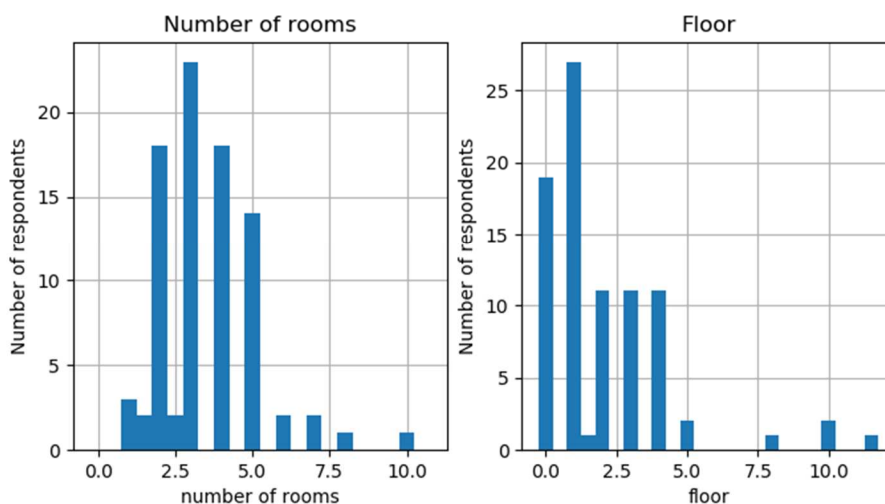
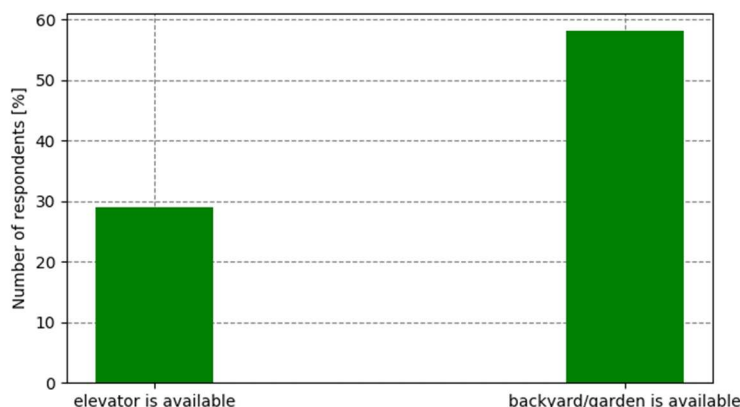
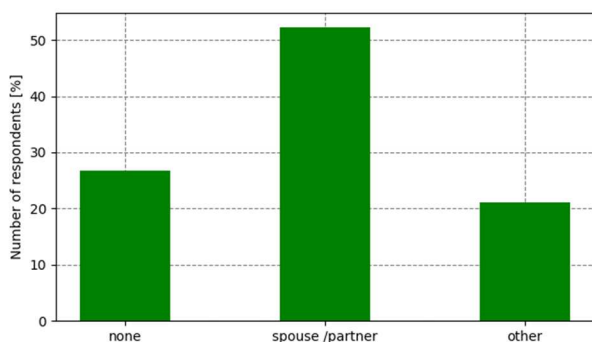


Figure 7: Number of rooms and floors

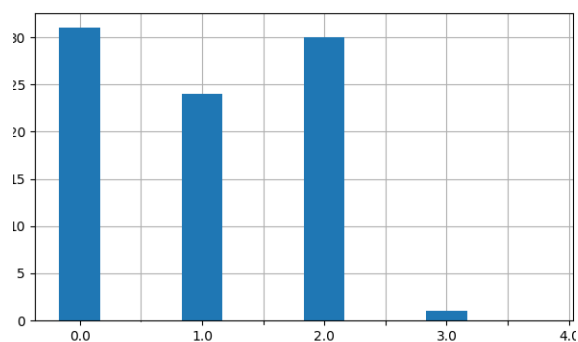


**Figure 8: Elevator and garden/backyard availability**

Answers to questions concerning other inhabitants were analyzed only for Respondents living in flats or houses. One fourth of them live alone (Figure 9). Majority of the surveyed primary users live with their spouses or partners. In some cases they share their flat/house with daughters (10), sons (6), grandchildren (2), sister (1) or son in law (1). In 62 percent of households there is at least one person aged 75 or over, including the Respondent (Figure 10).

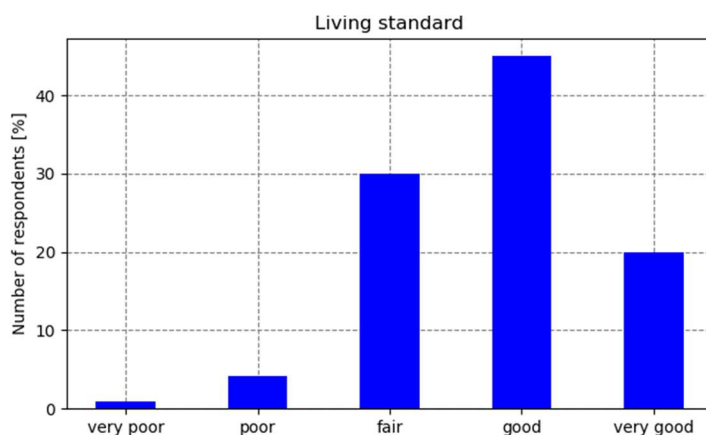


**Figure 9: Other inhabitants**



**Figure 10: Inhabitants older than 75 years**

Generally, the Respondents evaluate their living conditions as fair, good or very good. Only 5 percent perceives their living conditions as poor or very poor (Figure 11).

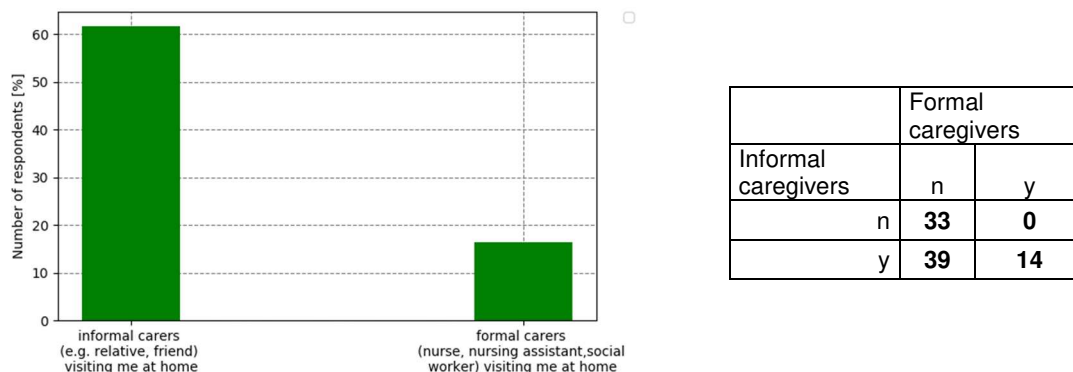


**Figure 11: Living conditions**

The Respondents were also asked about access to the Internet. Over three quarters of them can use the Internet at home.

### 4.2.3 Caregiving status

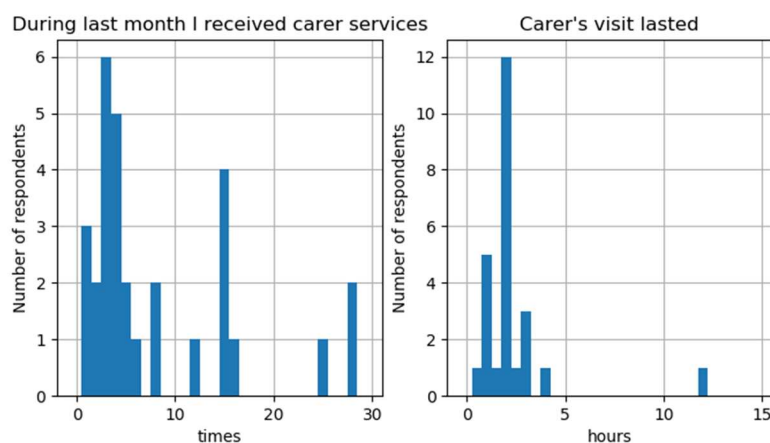
Analysis of the caregiving status was performed only for the Respondents not living in nursing homes. It was assumed that nursing homes are providing professional care services. Results of the survey confirm that Respondents mainly rely on informal carer services, only 14 out of 86 persons are supported by formal carers (Figure 12).



**Figure 12: Support from formal and informal caregivers**

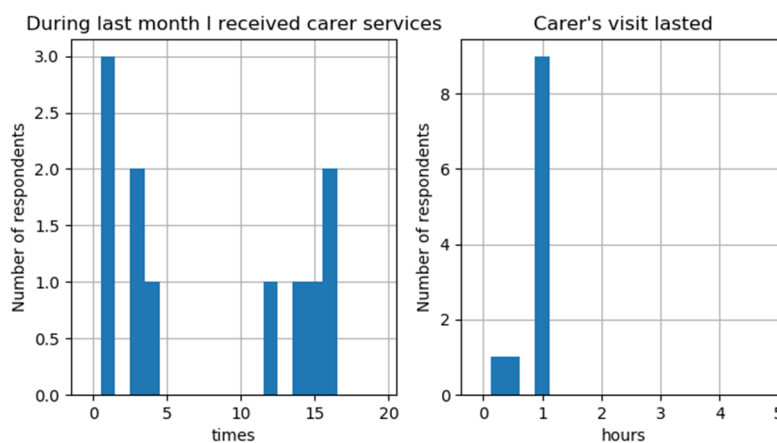
According to crosstable presented in the Figure 12, 33 persons do not obtain any caregivers support, 14 persons are supported by informal and formal carers.

Sixty percent of the analyzed group of the Respondents live with their informal carer. The other ones are supported during visits. Information on intensity and time of informal carers' visits are shown in Figures 13. Typical visit lasts less than two hours and takes place few times a month.



**Figure 13: Time and intensity of informal caregivers' visits**

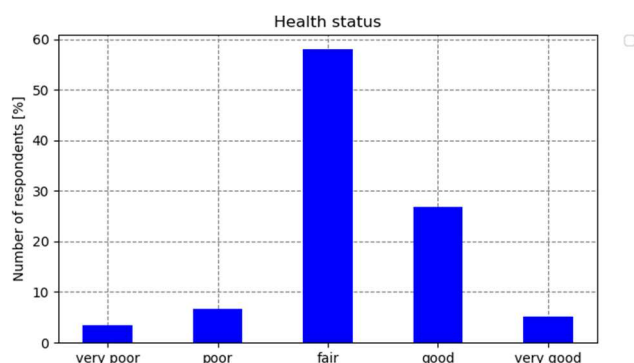
Only one Respondent lives with her formal carer. From data presented in Figure 14 we can conclude that intensity of care ranges from a few to several times a week, but time of visits is not longer than one hour.



**Figure 14: Time and intensity of formal caregivers' visits**

#### 4.2.4 Health status

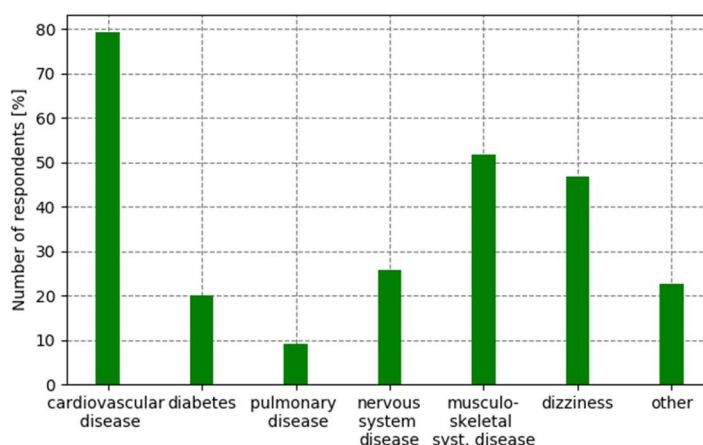
The Respondents were asked several questions concerning their health problems and impairments. The statistics describing general health status are shown in Figure 15. Majority of Respondents perceives their health as fair or good.



**Figure 15: Health status according to the Respondents**

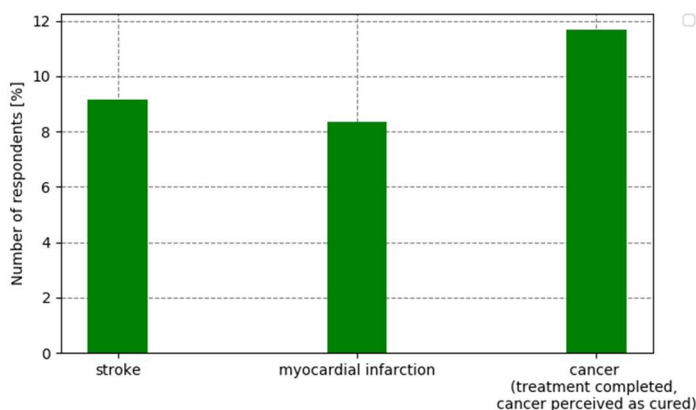
The perception of fair and good health is kept besides existing health problems. The statistics of chronic diseases is presented in Figure 16. Almost 80% of investigated group suffer from cardiovascular disease. Musculoskeletal system disease and dizziness are the problems of half of the Respondents.

According to the survey results, 94% of the Respondents take prescription medications every day. Perception of health status, despite many diseases, as fair or better than fair may indicate medical treatment efficiency.



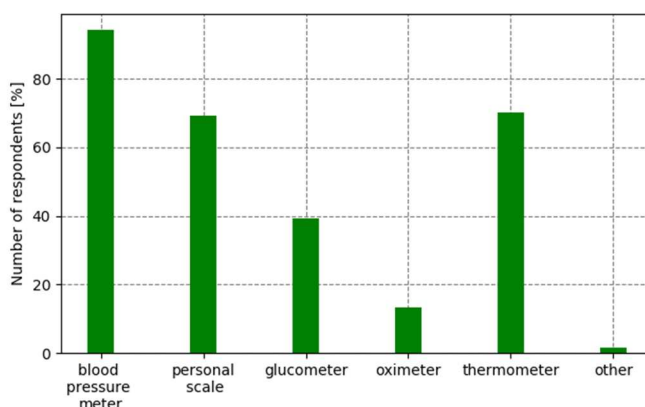
**Figure 16: Health problems statistics**

Some of the Respondents suffered from serious diseases in the past. Less than 10% had stroke and heart attack, 15% underwent cancer treatment (Figure 17).



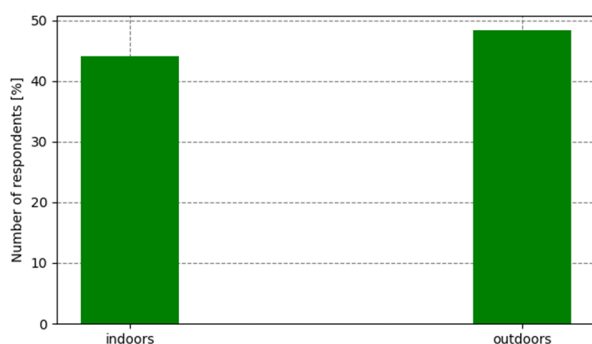
**Figure 17: Past diseases**

Most of the Respondents regularly use a blood pressure meter, a thermometer and a personal scale (Figure 18). Forty percent of surveyed persons regularly measure glucose blood levels, although only half of them suffer from diabetes. Oxygen saturation is not a common measurement, less than 15% of the Respondents use oximeters. Only one person admitted to use another device (pulse meter).



**Figure 18: Medical devices regularly used by Respondents**

Information on balance and walk disorders is important because of increased fall risk. More than 40 percent of the Respondents have problems with balance and walking indoors (Figure 19). The number slightly increases when persons leave their homes.

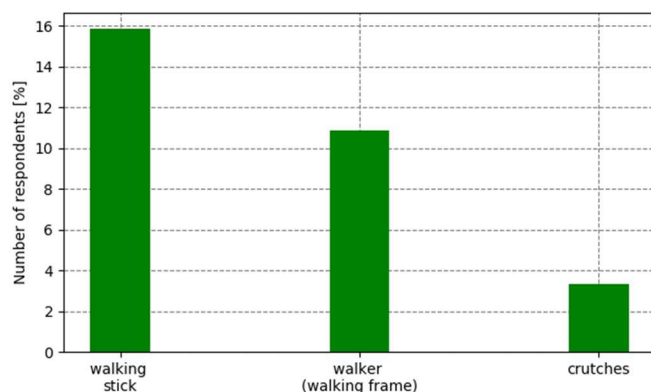


	Outdoors	
Indoors	n	y
n	58	9
y	4	49

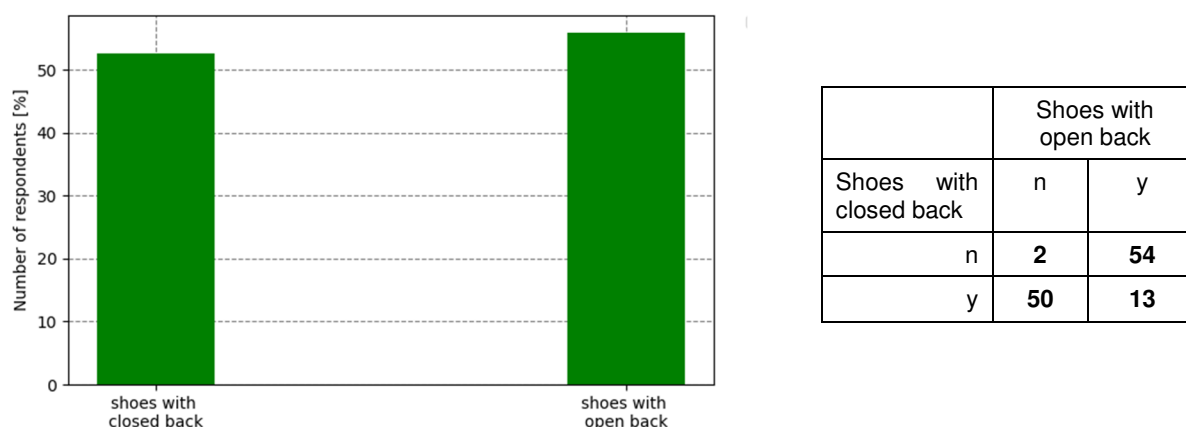
**Figure 19: Disorders of balance and walk**

Support when walking is required by a quarter of the surveyed group (Figure 20). Walking sticks and walkers are typically used for this purpose, but they are usually used alternatively (only one person declared using walking stick and a walker).

The survey Respondents were asked also about shoes they are using indoors. This information is important because the design of a shoe has an impacts on the risk of falls. Majority of the Respondents wear shoes with open back, so they are more vulnerable to falls (Figure 21). Ten percent of them wear both types of shoes. Collected data shows that shoes with closed back are more popular in nursing homes (e.g. almost all of the surveyed persons from Hungarian nursing homes). According to the survey results, primary users living in their homes and houses are typically using open back shoes.



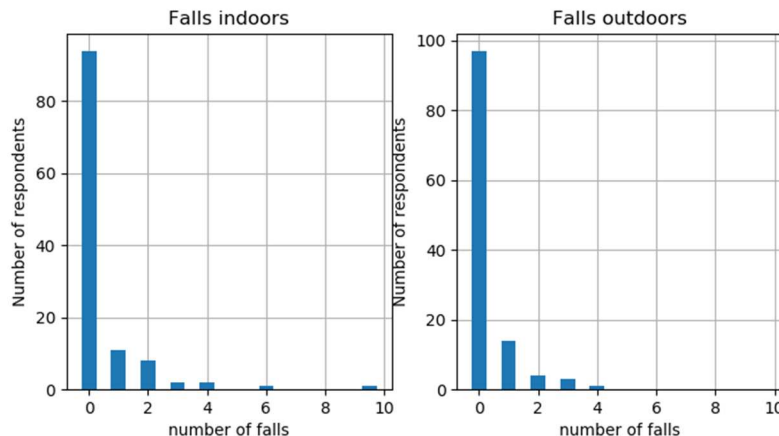
**Figure 20: Equipment supporting walking**



**Figure 21: Shoes used by the Respondents**

The Respondents were asked about number of falls they suffered during last 12 months indoors and outdoors. The majority did not report such accidents. Only several persons had falls. There is no significant relationship between the number of falls and environment (Figure 22).

These results are in discordance with data from multiple studies showing that approximately 50% of older adults experience at least one fall per year. On the other hand, our data confirm the conclusion of many studies that falls are underreported by older individuals and their caregivers. Only about 10-20% of falls result in visible injuries and, therefore, “minor” falls might not be considered as important by older people and are likely to be unnoticed by their relatives.

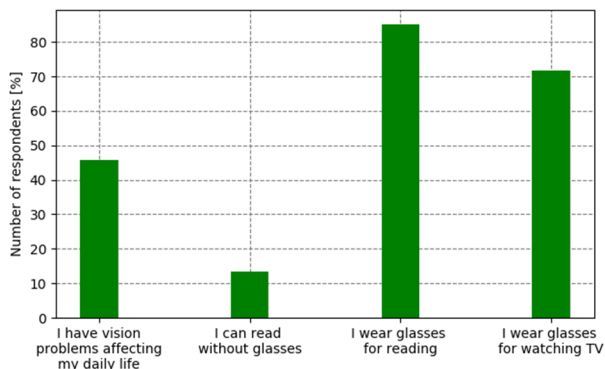


**Figure 22: Number of falls**

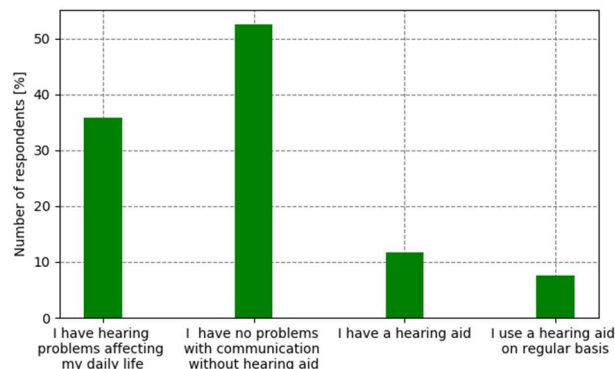
End users vision and hearing impairments have a significant impact on design of IONIS platform user interfaces. Therefore these problems were investigated in more detailed way. Almost half of the Respondents acknowledge that vision problems affect their daily life (Figure 23). More than eighty percent are not able to read without glasses and they use glasses for reading. Most of them also wear glasses when watching TV.

The IONIS platform will be equipped with functions supporting searching for significant items. According to the survey results described in section 4.2.6 one of the frequently searched objects are glasses. User interface connected with such functions should take into account vision problems reported by the Respondents – it should be designed with large fonts and icons in bright colors.

Hearing problems influence everyday life of one third of the surveyed group (Figure 24). More than half of them have no problems with communication. It means that for 10% of the Respondents problems with communication are not perceived to affect their daily life. Although the number of the Respondents having hearing problems is substantial, less than 15% have hearing aid and less than 10% is using it on a regular basis.



**Figure 23: Problems with vision**



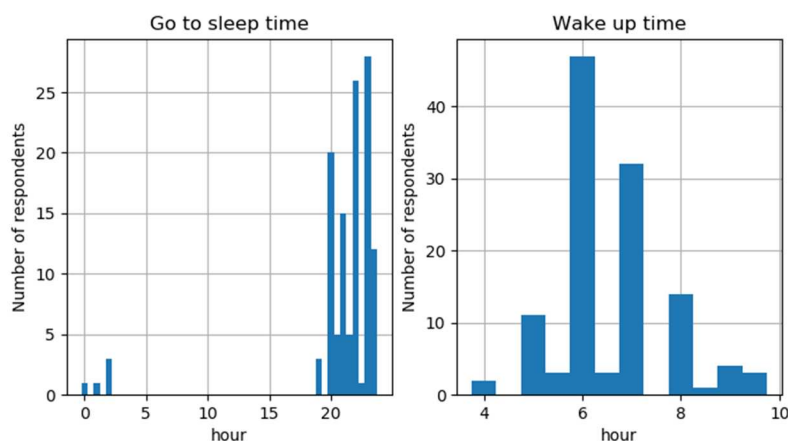
**Figure 24: Hearing problems**

Table 1 presents numbers of Respondents having problems with vision and hearing. Only 40 % do not have any of these problems. One fifth suffers from vision and hearing impairments.

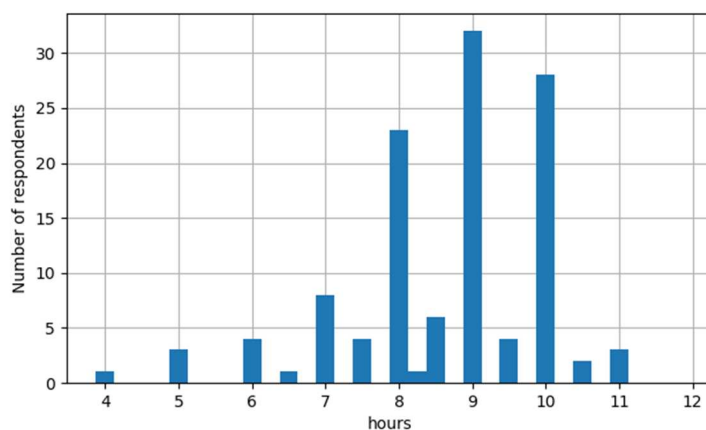
**Table 1: Vision and hearing problems (number of persons)**

Vision problems	Hearing problems	
	n	y
n	<b>48 (40%)</b>	<b>17 (14%)</b>
y	<b>29 (24%)</b>	<b>26 (22%)</b>

Sleep monitoring is one of the planned IONIS platform functionalities. A series of questions was related to the Respondents sleep problems. Majority of the Respondents go to sleep after 8 pm (a few after midnight) and wake up between 5 am and 8 am (Figure 25). Despite the time of going to sleep they spend in beds from 8 to 10 hours in beds (Figure 26).

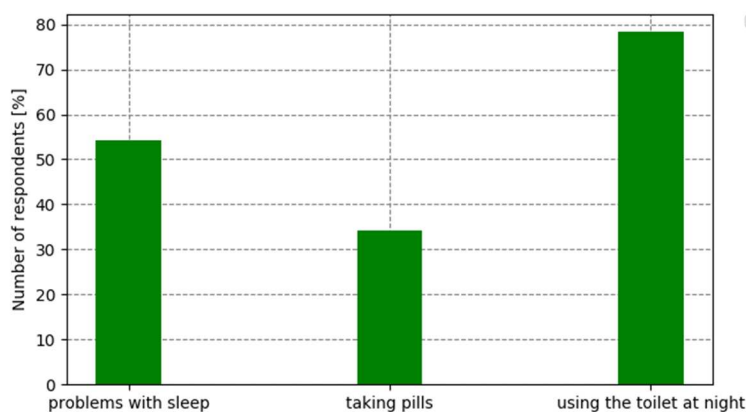


**Figure 25: Times of going to sleep and waking up**



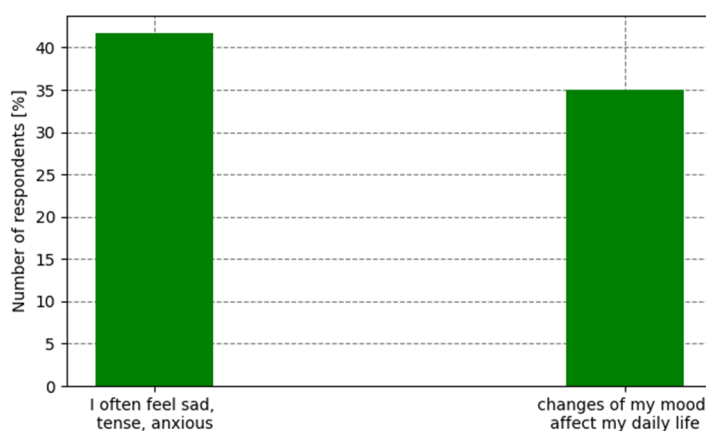
**Figure 26: Sleep times**

Although sleep times are long, more than half of the Respondents complain of sleep problems. One third of them often takes sleeping pills, 80% have to use the toilet during the night (Figure 27).



**Figure 27: Sleep problems**

The Respondents are not free from sadness, tension and anxiety (Figure 28). These feelings are often experienced by more than 70 % of the asked people. One third of them admitted that mood has an impact on their everyday life.

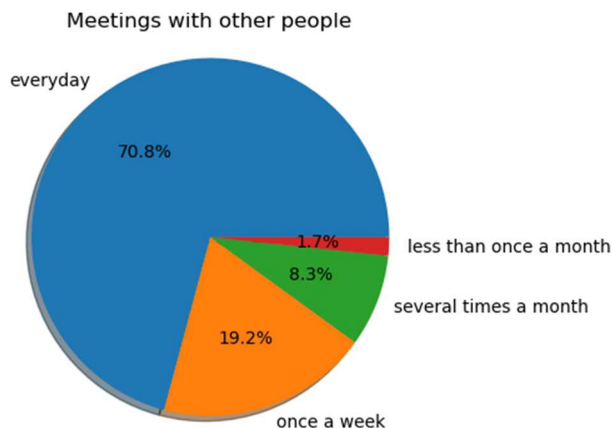


**Figure 28: Respondents' mood**

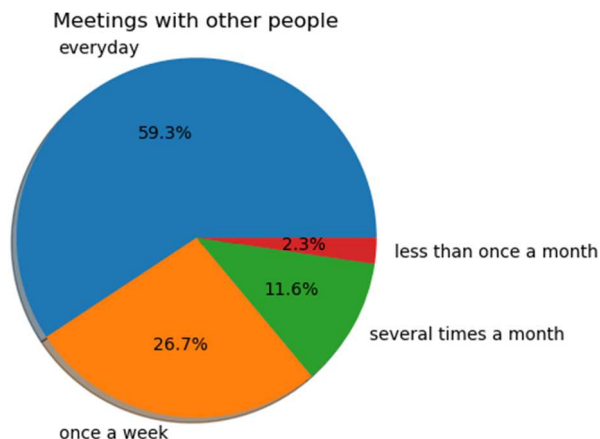


## 4.2.5 Social relations

Section 5 of the questionnaire dealt with the Respondents social relations. According to the Respondents' answers 70 percent of primary users meet other people every day (Figure 29). The number is biased by the Respondents living in nursing homes who live among other people.. Results corresponding to the persons living in their houses or flats are shown in Figure 30. Less than three percent meet other people less than once a month.



**Figure 29: Meetings with other people (all Respondents)**

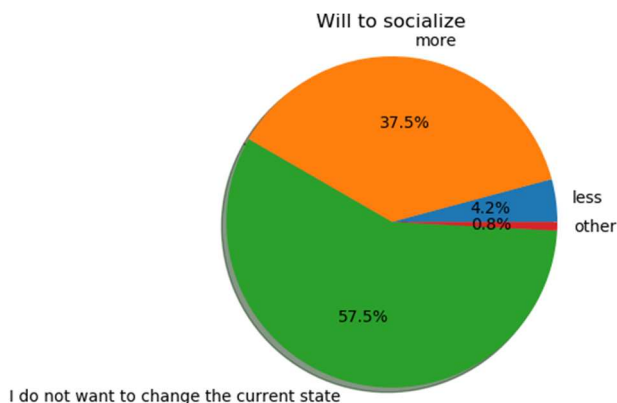


**Figure 30: Meetings with other people (Respondents not living in nursing homes)**

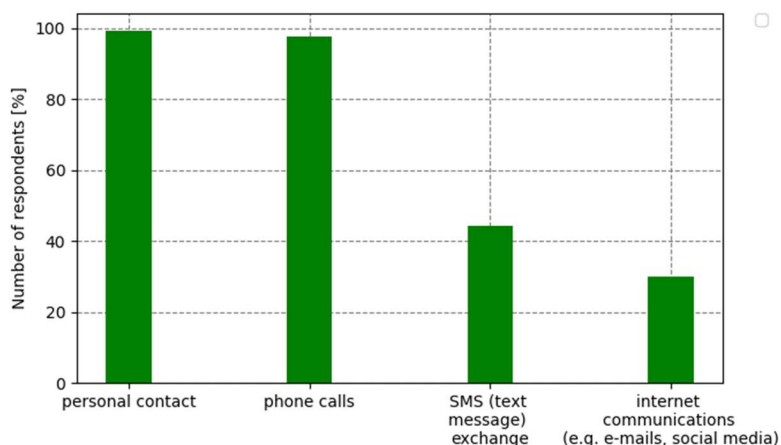
Most of the survey participants do not need to change the current state. One third expressed the will to socialize more (Figure 31).

The form of contacts with other people is important for the Respondents (Figure 32). Personal contact and phone calls are used by almost all surveyed persons.

The Respondents are less enthusiastic about electronic communications. Less than 50 percent use text messages (SMS). The number of users communicating over the Internet drops to 30 percent.



**Figure 31: Will to socialize**



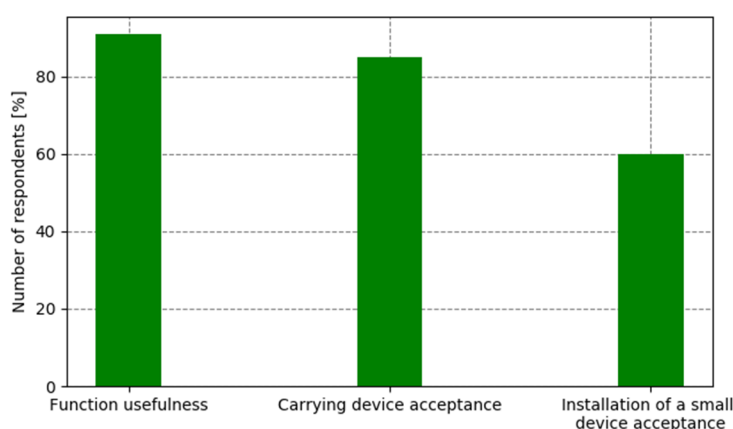
**Figure 32: Forms of communication used by Respondents**

## 4.2.6 IONIS system functions

The most important goal of the performed survey was collecting primary user's opinions on usability of services offered by the IONIS platform and whether they would accept activities required to perform system services effectively. In some cases the Respondents were asked to evaluate the proposed solutions and express additional opinions on the service or system functions.

### Fall detection

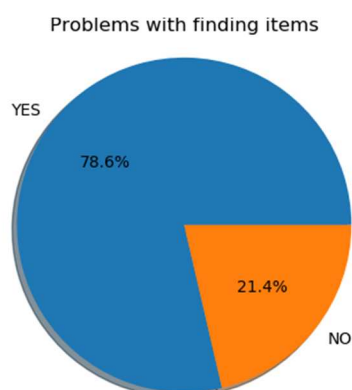
The first investigated functionality of the platform is connected with fall detection. The results confirm that the Respondents treat falls and their consequences very seriously. Vast majority of them think that this functionality is useful and accepts carrying small device (Figure 33). The smaller number of persons supporting installation of additional device at home results from lack of answers to this questions from many primary users living in nursing homes. Probably they do not feel they can decide on installation of any objects in those homes.



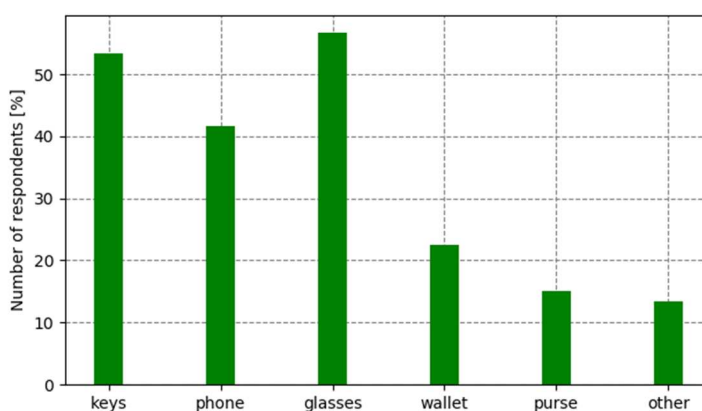
**Figure 33: Fall detection usefulness and acceptance**

### Finding items

According to the survey results, more than three quarters of the Respondents have problems with localizing their items (Figure 34). The most often searched objects are glasses, keys and phones (Figure 35). More than a half of the survey participants admitted they are typically looking for them.



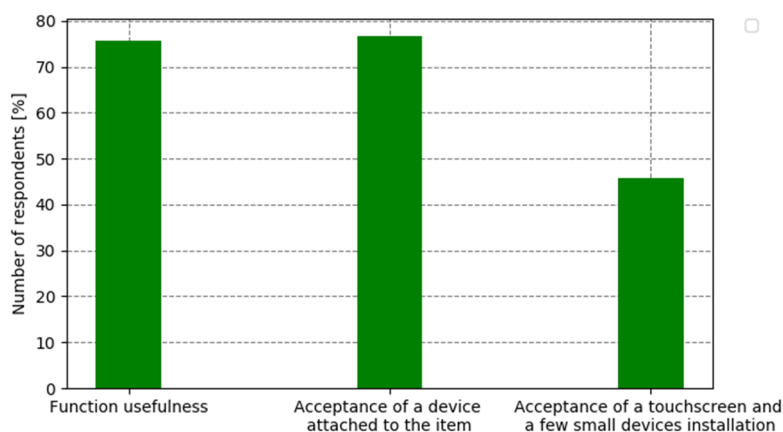
**Figure 34: Number of Respondents having problems with finding items**



**Figure 35: Items typically searched for**

Some of the Respondents extended the list of searched object by, clothes (1), shoes (1), remote control (5), dog leash (1), cigarettes (2), walking stick (2), pulse meter (1), medications (1), hearing aid (1), book (1), newspaper (1), food products to prepare meals (1), scissors (1), slippers (1).

Vast majority of Respondents considers item search support functionality as useful (Figure 36) and accepts attaching another devices to the searched objects. However there is a lower acceptance for installation of additional devices necessary for objects localization.

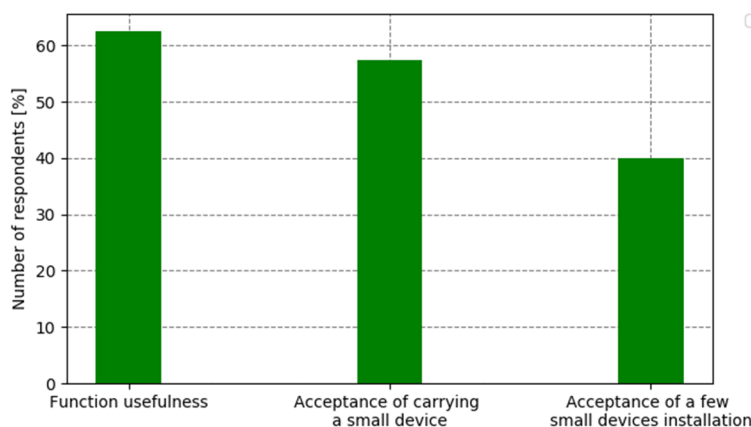


**Figure 36: Usefulness of finding items functionality an acceptance of devices supporting localization**

#### Mobility monitoring

The mobility monitoring function is intended for detection of situations indicating motor agitation ( e.g. anxiety, wandering). The system will collect and analyze information on primary user mobility. In case of abnormal mobility the system will inform the carer who will help to solve the problem.

The function is perceived as useful by most of the Respondents (Figure 37). They also accept devices necessary for their realization. However levels of support and acceptance is lower than in case of other services.

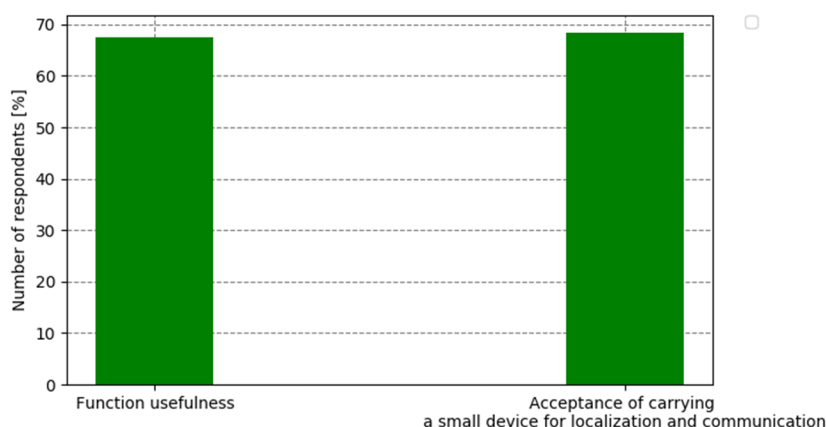


**Figure 37: Usefulness of mobility monitoring functionality an acceptance of supporting devices**

#### Localization outdoors

The function is intended to determine the Respondent's localization during outdoor activities (e.g. walking, shopping). If he/she forgets to find the way home the system will inform the caregiver on the problem and will send localization data.

According to two-third of the Respondents the functionality is useful (Figure 38). The same number accepts its implementation in devices carried by the person.

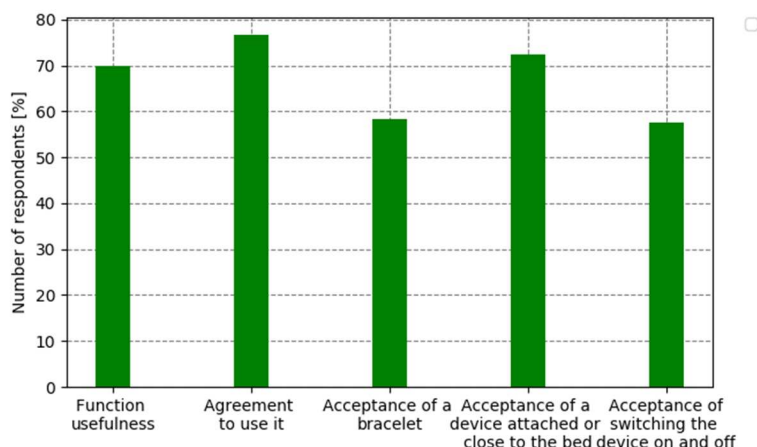


**Figure 38: Outdoor localization usefulness and acceptance of supporting devices**

### Sleep monitoring

The IONIS system implements sensors able to measure breath rate and detect body movements during sleep. Gathered data can be used for detection of sleep problems and could help to solve them.

Almost 70 percent of the Respondents see benefits from sleep monitoring and even more would agree to use such sensors (Figure 39). Respondents favor unobtrusive monitoring solutions. Bracelet worn during the night is accepted by 60 percent, whereas 74 percent accept sensors attached to the bed or located in bed vicinity. Almost 60 percent of the Respondents would be able to switch the sensors on in the evening and switch off in the morning. The rest would prefer more automated solution.

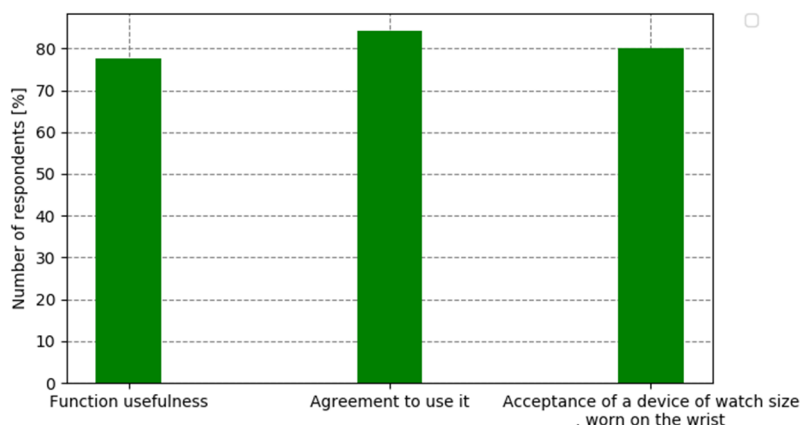


**Figure 39: Sleep monitoring functionality usefulness and acceptance of devices**

### Health monitoring with a smartwatch

The IONIS platform can collect data from smartwatches. Those devices equipped with many sensors, allow to investigate primary user's balance and detect changes in physiological parameters (e.g. pulse rate). Gathered data can be used for detection of changes in primary users' health and wellbeing.

According to survey results presented in Figure 40 majority of the Respondents perceive such functionality as useful, agree to use it and accept the form of the sensor.



**Figure 40: Smartwatch based health monitoring**

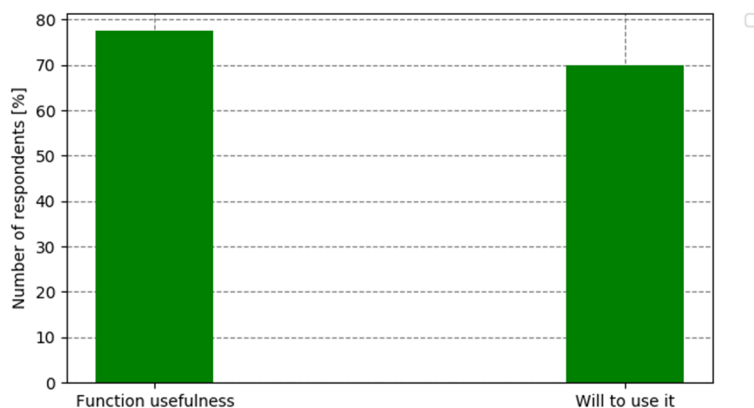
#### Collecting data from medical equipment

The IONIS platform is able to collect results from devices used for health related parameters measurements (e.g. blood pressure meter, personal scale, glucometer, oximeter, thermometer, pulse meter). The results are stored in the database and analyzed. The solution is highly accepted (85%) by the Respondents.

#### Personalized calendar

The IONIS platform is able to remind primary user about planned activities, events and important dates (e.g. relative's or friend's birthday). Personalized calendars with important agenda will be visible on tablet, computer or TV.

The survey shows that more than 75 percent of Respondents are convinced that the function is useful, but less than 70 percent expressed the will to use it (Figure 41).

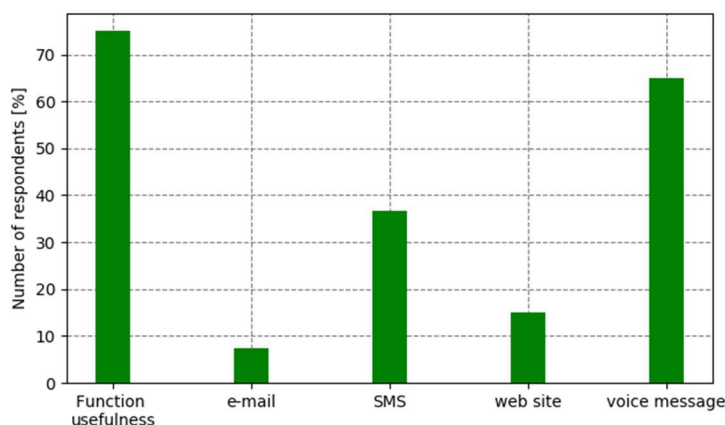


**Figure 41: Personalized calendar and will to use it**

#### Medication reminders

The IONIS platform can remind the primary users about medicines they have to take. Medication reminders can be displayed on a tablet, computer or TV, sent as an SMS message or played as a voice reminder.

According to the survey Respondents the function has similar usefulness as the personalized calendar (Figure 42). The survey participants were also asked to rate the means for reminders delivery. They reject sending the reminders by e-mails, they also do not perceive web site as useful. Approximately one third accept SMS based solution, but the biggest support was expressed for reminders announced with voice messages.



**Figure 42: Delivery of reminders to primary users**

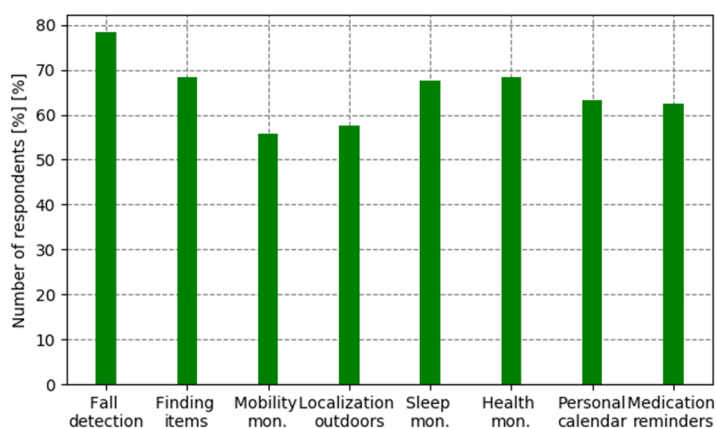
The last questionnaire question dealt with acceptance of installation in the house/flat an additional, small (book sized) device collecting and processing results from sensors. The total energy consumed by devices is at least two times lower than consumed by a standard refrigerator. Majority of the Respondents (83%) would accept such an installation in their homes.

#### Comparison of services usefulness

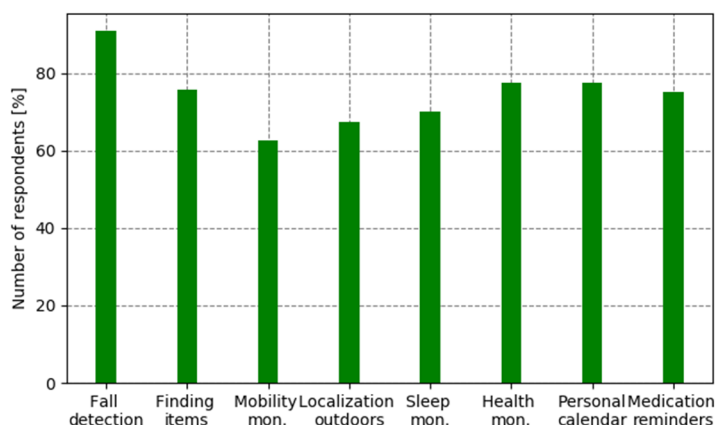
Besides the Respondents also Caregivers were asked about usefulness of IONIS system functions. The statistics of the collected answers is shown in Figure 43 and can be compared with Respondents' answers (Figure 44). The differences between opinions in both groups are very small. The biggest one (close to 10%) concerns only sleep monitoring which is more useful for the Caregivers.

All of the proposed solutions are perceived as useful by at least 63% of survey participants. Fall detection appeared to be the most important. Searching items support, health monitoring, personal calendar and medication reminders is claimed to be useful by 75% or more asked persons.

Lower usefulness estimation of mobility monitoring and outdoor localization may result from concerns about privacy violation.



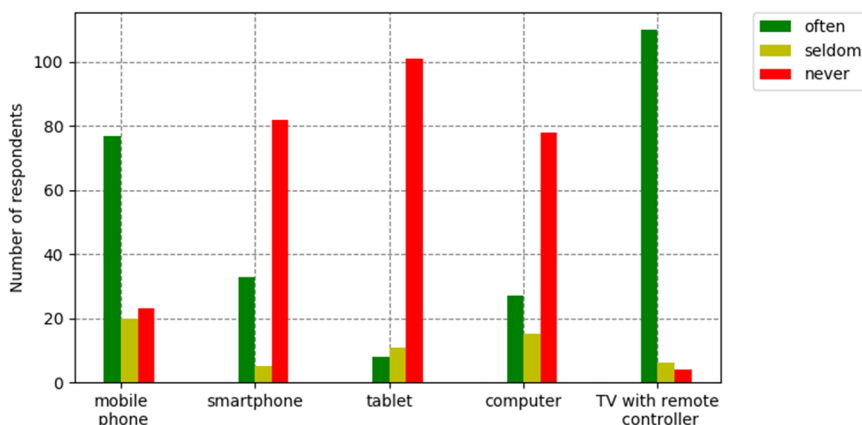
**Figure 43: Solutions usefulness according to caregivers**



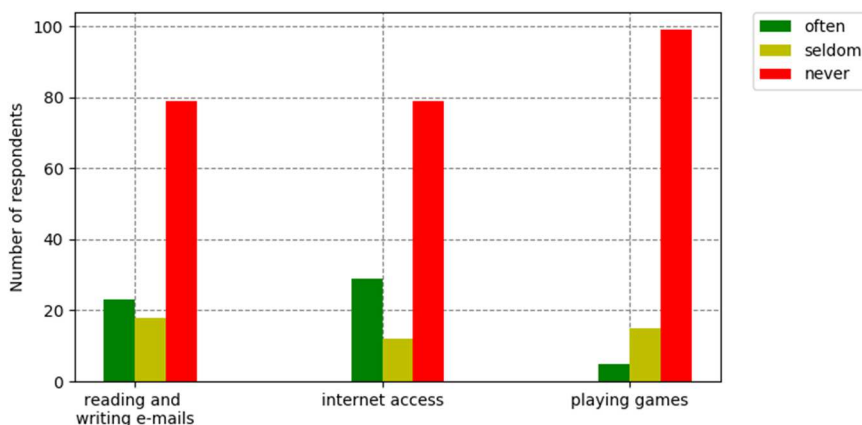
**Figure 44: Solutions usefulness according to Respondents**

### 4.2.7 Technology acceptance

Technology usage by the surveyed people seems to be rather low. Results of questions concerning intensity of modern devices usage are shown in Figure 45. Generally, the Respondents often use TV remote controllers and many of them also use mobile phones. Unfortunately, more advanced devices are not popular. Majority of Respondents have never used a smartphone, a computer or a tablet. Those who use those devices are mainly focused on internet browsing or communications via e-mail (Figure 46). Only a few persons play computer games.



**Figure 45: Use of technology devices**



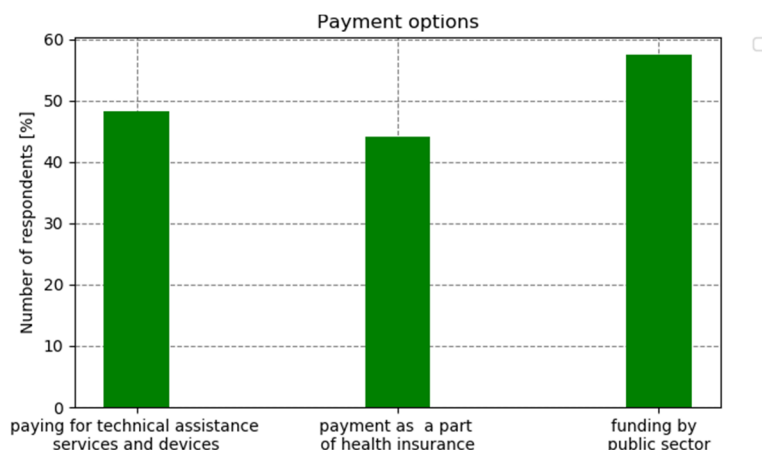
**Figure 46: Use of smartphones/tablets/computers**



## 4.2.8 Costs of services and devices

Cost of platform services have a significant impact on the platform acceptance. Therefore the survey included questions on payment options as well as on prices of devices. The questions were mainly answered by the primary users living in their houses or flats. Most of the nursing home inhabitants omitted these questions, because decisions on purchase of services and devices are taken by the nursing homes managing staff.

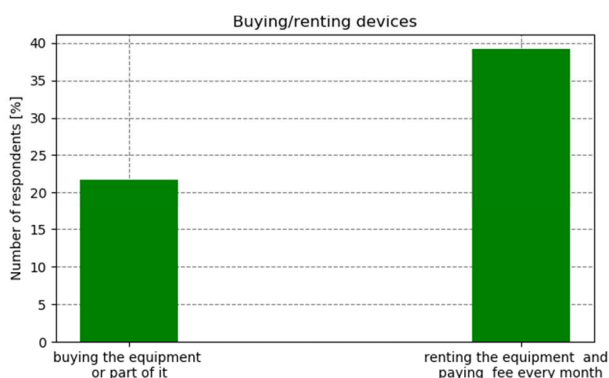
Two thirds of the asked persons would accept paying for technical assistant services and devices. The Respondents have also expectations concerning financing from other sources. Close to a half of them wish to have such services included in their health insurance (Figure 47). The most supported solution consists in funding of services and devices by the public sector.



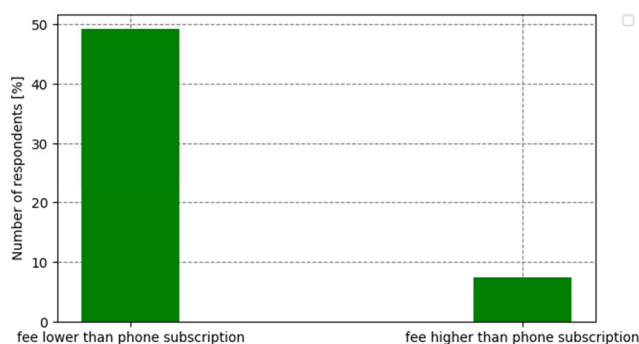
**Figure 47: Services and devices payment options**

The Respondents were also asked about way of obtaining the devices. Renting the equipment and paying fee every month is more popular than buying the equipment or a part of it. Many Respondents do not accept either forms of providing devices. They probably count on support of public sector and insurance institutions in this matter.

Renting of equipment can be financed by a monthly fee. Phone subscription costs were chosen as threshold for evaluation of fee acceptance. The results confirm expectations that the Respondents are willing to minimize costs (Figures 48 and 49). Lower fees have higher support, but there is a substantial group of users that do not accept any monthly fee. Only nine persons would be able to pay fees larger than phone subscriptions.



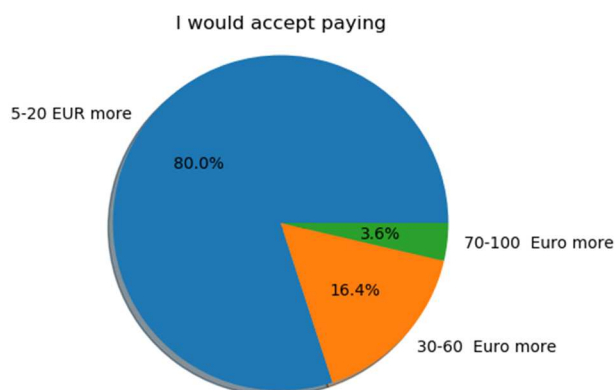
**Figure 48: Opinions on buying and renting devices**



**Figure 49: Monthly fee acceptance**

The last two questions concerned health monitoring devices (e.g. blood pressure meters, scales, glucometers, oximeters, thermometers). The aim was to check whether the Respondents would accept paying more for smart health monitoring devices (e.g. devices that can be connected to the IONIS platform) as compared to classical devices. About 57 percent of survey participants would accept to pay more, but increase in price should be not too big. Figure 50 shows the statistics of answers concerning amount of increase in price. Only 20 percent would accept increase by more than 30 euro.





**Figure 50: Increase in smart equipment price acceptance**

### 4.3 Impact of cognitive impairment on IONIS functions acceptance

During the research the MMSE score was taken as a measure of cognitive impairment. Project targets persons with MMSE in the range from 19 to 27. This range corresponds to two stages of cognitive impairment: mild dementia and mild cognitive impairment (MCI). Therefore for the purpose of further analysis Respondents were assigned to one of the above groups.

Usually it is assumed that MMSE score from 19 to 23 is typical for persons suffering from mild dementia, whereas the scores from 24 to 27 indicate MCI. In more detailed approach, the threshold between mild dementia and MCI depends on person's age and education. It is higher for younger and better educated people.

Table 2 presents relation between MMSE score and education level. It was decided that education level will not be taken into account as a factor having impact on assignment to mild dementia or mild cognitive impairment groups.

**Table 2: MMSE score versus education level**

MMSE score		19	20	22	23	24	25	26	27
Education level	master's degree or higher level	1	0	1	1	0	4	6	9
	post -secondary school	1	1	0	1	1	3	12	12
	secondary school	3	3	2	0	2	5	5	17
	primary school	5	1	1	1	7	4	2	9

The performed survey allows for investigation how cognitive impairment impacts the Respondent choices. Gathered data were used to investigate relationship between results of MMSE test and questionnaire answers concerning proposed IONIS functions and technology acceptance.

#### Memory problems

One of the cognitive impairment symptoms are memory problems. IONIS platform proposes a few functions supporting primary user activity influenced by this impairment.

Table 3 presents association between MMSE score and acceptance of personalized calendar and medication reminder.

**Table 3: MMSE versus personal calendar and medication reminder usefulness**

MMSE		19	20	22	23	24	25	26	27
Personalized calendar usefulness	n	1	0	4	2	1	2	5	12
	y	9	5	0	1	9	14	20	35

MMSE		19	20	22	23	24	25	26	27
Medication reminders	n	2	2	3	2	1	2	7	11
	y	8	3	1	1	9	14	18	36

According to both tables, the Respondents with lower MMSE results are convinced about usefulness of both proposed solutions. However percentage of functionalities supporters in mild dementia group is lower.

### Localization

Localization of items and persons is an unique feature in systems supporting people with cognitive impairment. Table 4 presents dependence between MMSE score and occurrence of problems related to searching items at home. The Respondents often have problems with finding items. According to Table 4, the percentage of persons having such problems in mild dementia group is slightly higher than in the second group (86% versus 77%).

**Table 4: MMSE versus searching items at home**

MMSE		19	20	22	23	24	25	26	27
Searching items at home	n	1	0	1	1	0	3	6	13
	y	9	5	3	2	10	13	19	34

As expected, the results from Table 5 show that support in searching items is required especially for persons with lower MMSE. However not all of the people in mild dementia group think that such support would be efficient. The percentage of Respondents with mild cognitive impairment thinking that this solution is useful is much higher. The reason for such difference could be a higher technology acceptance in this group.

**Table 5: MMSE versus finding items functionality**

MMSE		19	20	22	23	24	25	26	27
Finding items at home	n	3	0	1	2	0	2	8	13
	y	7	5	3	1	10	14	17	34

People suffering from cognitive impairment can lose orientation outdoors. The IONIS platform allows to track the person and react if the person gets lost. Although Respondents from mild dementia group are more endangered only 63% is convinced about the usefulness of this functionality, opposite to 70% in mild cognitive impairment group (Table 6).

**Table 6: MMSE versus localization outdoors functionality**

MMSE		19	20	22	23	24	25	26	27
Localization outdoors	n	3	1	1	3	1	5	9	15
	y	7	4	3	0	9	11	16	32

### Sleep problems

According to survey results 60 percent of persons from mild dementia group have problems with sleep and their number seems to increase with decrease in MMSE score (Table 7). The problem is less important for Respondents with higher MMSE scores (26 and 27).

**Table 7: MMSE versus sleep problems**

MMSE		19	20	22	23	24	25	26	27
Sleep problems	n	2	2	2	3	1	8	13	19
	y	8	3	2	0	9	8	12	28

Technology acceptance

Usage of ICT devices is a measure of technology acceptance. Table 8 contains data describing usage of devices by the particular Respondents groups. Except TV remote controller and mobile phone, the Respondents from mild dementia group never used tablets and smartphones. Only four persons use computer. The technology acceptance is better in the mild cognitive impairment group. One of the reasons can be better education of this group members.

**Table 8: MMSE versus usage of ICT devices**

	MMSE	19	20	22	23	24	25	26	27
mobile phone	often	3	3	3	2	6	10	15	35
	seldom	1	2	0	0	3	3	3	8
	never	6	0	1	1	1	3	7	4

	MMSE	19	20	22	23	24	25	26	27
smartphone	often	0	1	0	0	0	4	14	14
	seldom	0	0	0	0	0	1	1	3
	never	10	4	4	3	10	11	10	30

	MMSE	19	20	22	23	24	25	26	27
tablet	often	0	0	0	0	0	0	3	5
	seldom	0	0	0	0	0	1	6	4
	never	10	5	4	3	10	15	16	38

	MMSE	19	20	22	23	24	25	26	27
computer	often	1	1	0	0	0	6	8	11
	seldom	0	0	1	1	0	2	5	6
	never	9	4	3	2	10	8	12	30

	MMSE	19	20	22	23	24	25	26	27
TV set with a remote controller	often	6	4	4	3	9	15	25	44
	seldom	3	1	0	0	1	0	0	1
	never	1	0	0	0	0	1	0	2

## 5 Persona cards

### 5.1 Card preparation methodology

#### 5.1.1 Choice of parameters and clustering

Persona cards have been developed using an approach similar to the one used in T1.1. All Respondents were divided into two groups: persons living in nursing homes and the remaining ones. The division is justified by different scope of questionnaires filled by those groups. Nursing homes inhabitants could omit questions related to caregiving status or costs of services. Additionally the scope of their socialization activities is different.

In order to help persona developments, a clustering k-means algorithm was implemented. The algorithm operates on sets of objects with measurable attributes. In our case Respondents correspond to objects, answer to questionnaires questions converted to numbers are object attributes. Due to a large number of attributes, only some of them were chosen for clustering. The list of attributes chosen for analysis is presented in Table 9. Some of them, as age or MMSE score were normalized before calculations. All attributes have been assigned arbitrarily chosen weights.

**Table 9: Objects attributes used for Respondents clustering**

Attribute	Question number	Attribute Range	Weight	Weighted range
Education	1.1	4	0,25	0-1
Living place	2.1	2	0,5	0-1
Living alone with others	2.3	2	10	0-20
Caregiving status - informal	3.1a	1	2	0-2
Caregiving status - formal	3.1b	1	2	0-2
Health status	4.1	4	0.25	0-1
Taking medications	4.5	1	1	0-1
Disorders of balance and walk indoor	4.6a	1	4	0-4
Disorders of balance and walk outdoor	4.6b	1	4	0-4
Vision problems	4.11a	1	10	0-10
Hearing problems	4.12a	1	10	0-10
Sleep problems	4.13c	1	10	0-10
Sleep pills	4.13d	1	1	0-1
Using toilet during the night	4.13e	1	1	0-1
Mood	4.14a	1	1	0-1
Mood	4.14b	1	1	0-1
Social relations	5.1	3	2	0-6
Age (normalized to 63)	9.2	0-27	0,3	0-8,1
Gender	9.3	1	20	0-20
MMSE (normalized to 19)	9.4	0-8	20	0-160

### 5.1.2 Personas determination

The algorithm was run for nursing home inhabitants and the other Respondents separately. In case of the first group two clusters were found. However, analysis of object attributes belonging to both clusters has shown that groups differ mainly with MMSE score but vast majority of other parameters were the same. Therefore, nursing homes inhabitants were finally assigned to one cluster and one representing persona.

In case of the Respondents living in their homes, an attempt to find two clusters resulted in division into groups with significantly different number of objects. After analysis of the objects allocated to the larger group the difference in attributes forced a further division. Finally, Respondents living in their homes have been divided into three clusters, so three personas (P1, P2, P3) will represent this group. The numbers of the Respondents in the particular clusters are shown in Table 10.

**Table 10: Numbers of the Respondents in the particular clusters**

Persona/cluster	P1	P2	P3	P4
Number of Respondents in cluster	23	14	49	34

## 5.2 Persona cards


Analysis allowed to create four personas representing primary users participating in the multinational survey.

There are two personas (P2 and P4) with relatively low MMSE score (20,21) corresponding to mild dementia. The first one lives in a house, the second in a nursing home. They differ with standard of living, health and sleep problems. They also have different attitude to proposed IONIS platform functions.


Another two personas (P1, P3) correspond to persons living in their homes and having similar MMSE score (26,27). Persona P3 has more open attitude to technology. She accepts more of proposed IONIS platform solutions and she is more acquainted with modern computer and communications technology. She lives with family members whereas persona P1 lives in her home alone. Both rely on informal caregivers.

The detailed content of particular persona cards is presented in Tables 11-14. (photos are taken from the the [www.pexels.com](http://www.pexels.com) and [pixabay.com](http://pixabay.com) sites, they are covered by the Creative Commons Zero license and can be used for free for commercial and noncommercial purposes).


**Table 11: P1 - persona card**

Persona	IONIS platform primary user (P1)	
Photo		
Fictional name	Eleonore	
Demographics	76 years old lives in a flat alone perceives her living standard as good has access to the Internet at home receives care from informal caregiver education: post-secondary school	
Self-rated health	She rates her health status as good	
Health problems	She suffers from cardiovascular disease	
Regularly uses medical devices	She regularly uses blood pressure meter, personal scale and thermometer	
Impairments and disorders	She suffers from mild cognitive impairment (MMSE =27) She wears glasses for reading and watching TV	
Sleep problems	She has no problems with sleep, she usually has to use the toilet during the night	
Wellbeing	Changes of her mood do not affect her daily life	
Socialization	She meets with other people every day and does not want to change the current state She prefers personal contacts or phone calls for communication	
Use of electronic equipment and readiness to use ICT	She often uses mobile phone but never uses tablet, smartphone or computer. She has no problems with using a TV with a pilot.	
IONIS functionalities acceptance	She perceives the following platform functions as useful: <ul style="list-style-type: none"> <li>• fall detection,</li> <li>• items localization,</li> <li>• sleep monitoring,</li> <li>• health monitoring,</li> <li>• collecting data from medical instruments,</li> <li>• personalized calendar,</li> <li>• medication reminder.</li> </ul>	
Cost of services	She would accept paying for technical assistance services and devices but also expects including payment as a part of health insurance or funding by public sector She prefers renting than buying equipment. In case of monthly fee would accept the fee lower than phone subscription She would accept to pay 30-60 euro more for a smart health monitoring device (e.g. blood pressure meter, scale, glucometer, oximeter, thermometer)	

**Table 12: P2 - persona card**


Persona	IONIS platform primary user (P2)	
Photo		
Fictional name	John	
Demographics	77 years old lives in his house with family members perceives his living standard as fair has access to the Internet at home receives care from informal carer education: master's degree	
Self-rated health	He rates his health status as fair	
Health problems	He suffers from cardiovascular disease, diabetes and dizziness	
Regularly uses medical devices	He regularly uses blood pressure meter, glucometer, and thermometer	
Impairments and disorders	He suffers from mild dementia (MMSE =21), has disorders of balance and walk outdoors He wears glasses for reading and watching TV	
Sleep problems	He sometimes has problems with sleep, he usually has to use the toilet during the night	
Wellbeing	He often feels sad, tense or anxious, changes of his mood sometimes affect his daily life	
Socialization	He meets with other people once a week and does not want to change the current state . He prefers personal contacts or phone calls for communication	
Use of electronic equipment and readiness to use ICT	He often uses mobile phone but never uses tablet, smartphone or computer. He has no problems with using a TV with a pilot.	
IONIS functionalities acceptance	He perceives the following platform functions as useful: <ul style="list-style-type: none"> <li>• fall detection,</li> <li>• items localization,</li> <li>• health monitoring,</li> <li>• collecting data from medical instruments.</li> </ul>	
Cost of services	He would expects payment for technical assistance services and devices as a part of health insurance or funding by public sector	

**Table 13: P3 - persona card**

Persona	IONIS platform primary user (P3)	
Photo		
Fictional name	Ruth	
Demographics	77 years old lives in a flat with family members perceives her living standard as good has access to the Internet at home receives care from informal carer education: post-secondary school	
Self-rated health	She rates her health status as fair	
Health problems	She suffers from cardiovascular disease	
Regularly uses medical devices	She regularly uses blood pressure meter, personal scale and thermometer	
Impairments and disorders	She suffers from mild cognitive impairment (MMSE =26), she wears glasses for reading and watching TV	
Sleep problems	She has no problems with sleep, she usually has to use the toilet during the night	
Wellbeing	Changes of her mood do not affect her daily life	
Socialization	She meets with other people every day and does not want to change the current state. She prefers personal contacts or phone calls for communication	
Use of electronic equipment and readiness to use ICT	She often uses mobile phone, seldom smartphone, Never uses tablet, seldom uses computer for reading and writing e-mails or internet access. She has no problems with using a TV with a pilot	
IONIS functionalities acceptance	She perceives the following platform functions as useful: <ul style="list-style-type: none"> <li>• fall detection,</li> <li>• items localization,</li> <li>• mobility monitoring,</li> <li>• localization outdoors, sleep monitoring,</li> <li>• health monitoring,</li> <li>• collecting data from medical instruments,</li> <li>• personalized calendar,</li> <li>• medication reminder.</li> </ul>	
Cost of services	She would accept paying for technical assistance services and devices but also expects including payment as a part of health insurance or funding by public sector She prefers renting than buying equipment. In case of monthly fee would accept the fee lower than phone subscription She would accept to pay 30-60 euro more for a smart health monitoring device (e.g. blood pressure meter, scale, glucometer, oximeter, thermometer)	



**Table 14: P4 - persona card**

Persona	IONIS platform primary user (P4)	
Photo		
Fictional name	Sybille	
Demographics	83 years old lives in a nursing home perceives her living standard as fair no access to the Internet education: primary school	
Self-rated health	She rates her health status as fair	
Health problems	She suffers from cardiovascular disease, nervous system disease, musculoskeletal system disease and dizziness	
Regularly uses medical devices	She regularly uses blood pressure meter, glucometer, personal scale and thermometer	
Impairments and disorders	She suffers from mild dementia (MMSE =20), has disorders of balance and walk indoors and outdoors. She has vision problems affecting her daily life, she wears glasses for reading and watching TV	
Sleep problems	She has problems with sleep and often takes sleeping pills, she usually has to use the toilet during the night	
Wellbeing	She often feels sad, tense, or anxious, changes of her mood affect her daily life	
Socialization	She meets with other people every day and would like to socialize more. She prefers personal contacts or phone calls for communication	
Use of electronic equipment and readiness to use ICT	She often uses mobile phone, but never uses tablet, smartphone or computer. She has no problems with using a TV with a pilot,	
IONIS functionalities acceptance	She perceives the following platform functions as useful: <ul style="list-style-type: none"> <li>• fall detection,</li> <li>• items localization,</li> <li>• mobility monitoring,</li> <li>• localization outdoors, sleep monitoring,</li> <li>• health monitoring,</li> <li>• collecting data from medical instruments,</li> <li>• personalized calendar,</li> <li>• medication reminder.</li> </ul>	

## 6 Conclusions

The Deliverable D1.2 described the IONIS multinational survey that was conducted based on unanimous questionnaires among respondents with cognitive impairment and their caregivers, if available. The scope of the survey included characteristics of the potential users of the IONIS platform and their willingness to accept proposed technological solutions. The questions covered the pertinent aspects to the future IONIS end-users:

- living arrangements,
- impairments,
- caregiving status,
- health status, social relations,
- IONIS platform functions acceptance, technology acceptance and
- tolerable cost of services.

The survey was conducted by end-user organizations of the four end-user countries of the consortium: Poland, Slovenia, Romania and Hungary by the consortium end-user partners: DGW, IZRIIS/ASLO, CITST and ASH, respectively. The questionnaires for primary users (Respondents) and their Caregivers were unanimous, which led for comparison and verification of the obtained answers.

The performed survey allowed for the investigation of how cognitive impairment impacts the Respondent choices. Gathered data were used to investigate relationship between results of MMSE test and questionnaire answers concerning proposed IONIS functions and technology acceptance. From the statistical analysis of the obtained results of the performed survey that collected primary user's opinions on usability of services offered by the IONIS platform and whether they would accept activities required to perform system services effectively, we can conclude the following:

- One of the cognitive impairment symptoms are memory problems. IONIS platform proposes a few functions supporting primary user activity influenced by this impairment. According to the obtained results, the Respondents with lower MMSE results are convinced about the usefulness of the IONIS proposed solutions. However, percentage of functionalities supporters in mild dementia group is lower.
- Localization of items and persons is a unique feature in systems supporting people with cognitive impairment. The Respondents often have problems with finding items. Support in searching items is required especially for persons with lower MMSE. However not all of the people in mild dementia group think that such support would be efficient. The percentage of Respondents with mild cognitive impairment thinking that this solution is useful is much higher. The reason for such difference could be a higher technology acceptance in this group.
- People suffering from cognitive impairment can lose orientation in outdoors environments. The IONIS platform allows to track the person and react if the person gets lost. At the average, such tracking solution was found of interest for them: Respondents from mild dementia group are more endangered only 63% is convinced about the usefulness of this functionality, opposite to 70% in mild cognitive impairment group.
- According to survey results, 60 percent of persons from mild dementia group have problems with sleep and their number seems to increase with decrease in MMSE score. The problem is less important for Respondents with higher MMSE scores.
- Usage of ICT devices is a measure of technology acceptance. Except TV remote controller and mobile phone, the Respondents from mild dementia group never used tablets and smartphones. Only four persons use computer. The technology acceptance is better in the mild cognitive impairment group. One of the reasons can be better education of this group members.

The "Conjoint analysis" that is planned in Task T1.3 will continue the study that was initiated in Deliverable D1.2. It will deliver results of conjoint analysis and implications for system design that will be documented in D1.3. "Conjoint analysis report".

## 7 Annexes

### 7.1 Questionnaire for a Respondent

#### 1 Demographic data

1.1 I have finished my education at: (please circle your response)

- a) master degree or higher level
- b) post -secondary school
- c) secondary school
- d) primary school
- e) no formal education

#### 2 Living arrangements

2.1 I live in a : (please circle your response)

- a) house      b) flat    c) room in a nursing home

2.2 If you live in the house or the flat please provide the following information

- a) number of rooms \_\_\_\_\_
- b) approximate area [square meters] \_\_\_\_\_
- c) floor \_\_\_\_\_
- d) elevator is available YES NO
- e) backyard/garden is available YES NO

2.3 Other inhabitants (please circle your response)

- a) none      b) spouse /partner      c) other, if other, please specify \_\_\_\_\_

2.4 A number of inhabitants (in the house/flat) aged over 75 years (including me) \_\_\_\_\_

2.5 I think that my living standard is: (please circle your response)

- a) very poor    b) poor    c) fair    d) good      e) very good

2.6 I have access to the Internet at home YES NO

#### 3 Caregiving status

3.1 I receive care from

- a) informal carers (e.g. relative, friend) visiting me at home YES NO
- b) formal carers (nurse, nursing assistant, social worker) visiting me at home YES NO

3.2 Informal Carer (if applicable)

- a) informal carer (e.g. relative, friend) lives with me YES NO
- b) during last month I received carer services approximately  
(please do not fill if you cannot remember) \_\_\_\_\_ times

c) usually carer's visit lasted for  
(please do not fill if you cannot remember) \_\_\_\_\_ hours

### 3.3 Formal Carer (if applicable)

a) formal carer (e.g. relative, friend) lives with me YES NO

b) during last month I received carer services approximately  
(please do not fill if you cannot remember) \_\_\_\_\_ times

c) usually carer's visit lasted for  
(please do not fill if you cannot remember) \_\_\_\_\_ hours

## 4 Health status

4.1 I rate my health status as: (please circle your response)

a) very poor b) poor c) fair d) good e) very good

4.2 I have health problems such as:

a) cardiovascular disease	YES	NO
b) diabetes	YES	NO
c) pulmonary disease	YES	NO
d) nervous system disease	YES	NO
e) musculoskeletal system disease	YES	NO
f) dizziness	YES	NO
g) other	YES	NO

.....

4.3 I suffered from the following diseases in the past:

a) stroke	YES	NO
b) myocardial infarction	YES	NO
c) cancer (treatment completed, cancer perceived as cured)	YES	NO

4.4 I am regularly using the following devices for health or fitness monitoring:

a) blood pressure meter	YES	NO
b) personal scale	YES	NO
c) glucometer	YES	NO
d) oximeter	YES	NO
e) thermometer	YES	NO
f) other - please specify	YES	NO

.....

4.5 I take medications prescribed by a doctor everyday YES NO

4.6 I have disorders of balance and walk:

a) indoors	YES	NO
b) outdoors	YES	NO

4.7 I fell \_\_\_\_\_ times during last 12 months indoors

4.8 I fell \_\_\_\_\_ times during last 12 months outdoors

4.9 I use the following equipment supporting walking:

a) walking stick	YES	NO
b) walker (walking frame)	YES	NO
c) crutches	YES	NO

4.10 I use the following shoes indoors:

a) shoes with closed back	YES	NO
b) shoes with open back	YES	NO

4.11 Vision problems

a) I have vision problems affecting my daily life	YES	NO
b) I can read without glasses	YES	NO
c) I wear glasses for reading	YES	NO
d) I wear glasses for watching TV	YES	NO

4.12 Hearing problems

a) I have hearing problems affecting my daily life	YES	NO
b) I have no problems with communication without hearing aid	YES	NO
c) I have a hearing aid	YES	NO
d) I use a hearing aid on regular basis	YES	NO

4.13 Sleep

a) I usually go to sleep at ..... in the evening (please specify the hour)

b) I usually wake up at ..... in the morning (please specify the hour)

c) I have problems with sleep	YES	NO
d) I often take sleep pills	YES	NO
e) I usually have to use the toilet during the night	YES	NO

4.14 Mood

a) I often feel sad, tense, anxious	YES	NO
b) changes of my mood affect my daily life	YES	NO

## 5 Social relations

5.1 I meet with other people (I socialize): (please circle your response)

a) everyday    b) once a week    c) several times a month    d) less than once a month

5.2 I would like to socialize (please circle your response)

- a) less b) more c) I do not want to change the current state d) other

5.3 I use the following forms of communication:

- |   |     |    |
|---|-----|----|
| a) personal contact                                     | YES | NO |
| b) phone calls  | YES | NO |
| c) SMS (text message) exchange                          | YES | NO |
| d) internet communications (e.g. e-mails, social media) | YES | NO |

## 6 IONIS system functions

The IONIS system will be equipped with many functions intended to support some of your activities and increase your safety. The proposed functions and remarks concerning their implementations are listed below

### 6.1 Fall detection

In case of a fall the system will inform your carer:

- |   |     |    |
|---|-----|----|
| a) I perceive this function as useful                                 | YES | NO |
| b) I would accept carrying a small device for fall detection purposes | YES | NO |
| c) I would accept installing a small device in the house/flat         | YES | NO |

### 6.2 Finding items

- |  |     |    |
|--|-----|----|
| a) I have some problems with finding small items at home | YES | NO |
|--|-----|----|

If yes, I am usually looking for: (please circle the correct responses)

- b) keys c) phone d) glasses  
e) wallet f) purse  
g) other (please state) .....

### 6.3 The system will help you to find items in your home

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful  | YES | NO |
| b) I would accept small device attached to the item                                  | YES | NO |
| c) I would accept installing a touchscreen and a few small devices in the house/flat | YES | NO |

### 6.4 Monitoring mobility

The function is intended for detection of situations indicating motor agitation ( e.g. anxiety, wandering). The system will collect and analyze information on your mobility. The system will inform the carer who will help to solve the problem.

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful                              | YES | NO |
| b) I would accept carrying a small device for mobility monitoring  | YES | NO |
| c) I would accept installing a few small devices in the house/flat | YES | NO |

### 6.5 Localization outdoors

The function is intended to determine your localization during walking, shopping. If you forget to find your way home the system will inform your carer on your localization.

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful  | YES | NO |
| b) I would accept carrying a small device for outdoor localization and communication | YES | NO |

#### 6.6 Sleep quality monitoring

The system will measure breath rate and detect your movements when you sleep. Gathered data will be used for detection of sleep problems and could help to solve them.

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful  | YES | NO |
| b) I would agree to use it   | YES | NO |
| c) I would accept bracelet like device   | YES | NO |
| d) I would accept placing a small device close to my bed or a small device attached to the bed       | YES | NO |
| e) I would accept switching the monitor device on in the evening and switching it off in the morning | YES | NO |

#### 6.7 Health monitoring

The system based on a smartwatch (a device equipped with sensors worn as a wristwatch) will investigate your balance and detect change in your health

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful                      | YES | NO |
| b) I would agree to use it                                 | YES | NO |
| c) I would accept a device of watch size, worn on my wrist | YES | NO |

6.8 The system is also able to collect results from devices used for health related parameters measurements (e.g. blood pressure meter, personal scale, glucometer, oximeter, thermometer, pulse meter)

- |                                       |     |    |
|---------------------------------------|-----|----|
| a) I perceive this function as useful | YES | NO |
|---------------------------------------|-----|----|

#### 6.9 Personalized calendar

The system will remind you about planned activities, events and important dates (e.g. relative's or friend's birthday). Personalized calendars for the current day with important agenda will be visible on tablet, computer or TV.

- |                                       |     |    |
|---------------------------------------|-----|----|
| a) I perceive this function as useful | YES | NO |
| b) I would like to use it             | YES | NO |

#### 6.10 Medication reminders

The system will remind you about medicines you have to take. Medication reminders will be visible on tablet, computer or TV send in SMS message to the phone, played as a vocal reminder.

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful                                | YES | NO |
| b) I think that use of e-mail for this purpose is useful             | YES | NO |
| c) I think that use of SMS for this purpose is useful                | YES | NO |
| d) I think that use of web site interface for this purpose is useful | YES | NO |
| e) I think that use of voice message for this purpose is useful      | YES | NO |

6.11 Most of system functions require use of an additional, small (book sized) device collecting and processing results from sensors.

I would accept installing such device in the house/flat - the total energy consumed by devices is at least two times lower than consumed by a standard refrigerator) YES NO

## 7 Technology acceptance

I am using the following devices: (please circle your response)

- |     |                                 |          |           |          |
|-----|---------------------------------|----------|-----------|----------|
| 7.1 | mobile phone                    | a) often | b) seldom | c) never |
| 7.2 | smartphone                      | a) often | b) seldom | c) never |
| 7.3 | tablet                          | a) often | b) seldom | c) never |
| 7.4 | computer                        | a) often | b) seldom | c) never |
| 7.5 | TV set with a remote controller | a) often | b) seldom | c) never |

I am using a smartphone/tablet/computer for the following activities: (please circle your response)

- |     |                            |          |           |          |
|-----|----------------------------|----------|-----------|----------|
| 7.6 | Reading and writing emails | a) often | b) seldom | c) never |
| 7.7 | Internet access            | a) often | b) seldom | c) never |
| 7.8 | Playing games              | a) often | b) seldom | c) never |

## 8 Costs of services

### 8.1 Payment options

- |  |     |    |
|--|-----|----|
| a) I would accept paying for technical assistance services and devices | YES | NO |
| b) I expect including payment as a part of health insurance            | YES | NO |
| c) I expect funding by public sector                                   | YES | NO |

### 8.2 I prefer the following solutions:

- |   |     |    |
|---|-----|----|
| a) buying the equipment or part of it               | YES | NO |
| b) renting the equipment and paying fee every month | YES | NO |

### 8.3 In case of monthly fee:

- |  |     |    |
|--|-----|----|
| a) I would accept the fee lower than phone subscription  | YES | NO |
| b) I would accept the fee higher than phone subscription | YES | NO |

8.4 In case of health monitoring devices (e.g. blood pressure meter, scale, glucometer, oximeter, thermometer) I would accept to pay more for a smart health monitoring device (e.g. device that can be connected to the IONIS platform) as compared to a classical device

YES NO

If I would accept paying:

- a) 5-20 Euro more    b) 30-60 Euro more    c) 70-100 Euro more



## QUESTIONNAIRE PART TO BE FILLED BY THE INTERVIEWER

### 9 Demographic data

- 9.1 Questionnaire code \_\_\_\_\_
- 9.2 Age (in yrs) \_\_\_\_\_
- 9.3 Gender           a) male                               b) female
- 9.4 MMSE score \_\_\_\_\_ / 30 pts \_\_\_\_\_
- 9.5 ADL score \_\_\_\_\_ / 6 pts \_\_\_\_\_
- 9.6 IADL score \_\_\_\_\_ / 8 pts \_\_\_\_\_
- 9.7 Did the Respondent replied give answers to all questions?                               YES                               NO
- 9.8 The assistance was required in the following questions:
- \_\_\_\_\_
- \_\_\_\_\_

## 7.2 Questionnaire for a Carer

### 1 Respondent's demographic data

- 1.1 The Respondent has finished her/his education at: (please circle your response)
- a) master degree or higher level
- b) post -secondary school
- c) secondary school
- d) primary school
- e) no formal education

### 2 Living arrangements

- 2.1 The Respondent lives in a : (please circle your response)
- a) house           b) flat   c) room in a nursing home
- 2.2 If the Respondent lives in the house or the flat please provide the following information
- a) number of rooms \_\_\_\_\_
- b) approximate area [square meters] \_\_\_\_\_
- c) floor \_\_\_\_\_
- d) elevator is available                               YES                               NO
- e) backyard/garden is available                               YES                               NO
- 2.3 Other inhabitants (please circle your response)
- a) none           b) spouse /partner           c) other, if other, please specify
- \_\_\_\_\_

2.4 A number of inhabitants (in the house/flat) aged over 75 years (including the Respondent)

2.5 I think that the Respondent's living standard is: (please circle your response)

a) very poor    b) poor    c) fair    d) good    e) very good

2.6	The Respondent has access to the Internet at home	YES	NO
-----	---	-----	----

### 3 Caregiving status

### 3.1 The Respondent receives care from

a) informal carer (e.g. relative, friend) visiting her/him at home	YES	NO
--	-----	----

b) formal carer (nurse, nursing assistant, social worker) visiting her/him at home	YES	NO
--	-----	----

### 3.2 Informal Carer (if applicable)

a) informal carer lives with the Respondent	YES	NO
---	-----	----

b) during last month the Respondent received carer services approximately (please do not fill if you don't know or cannot remember) times

c) usually visit lasted for \_\_\_\_\_  
(please do not fill if you don't know or cannot remember) \_\_\_\_\_ hours

### 3.3 Formal Carer (if applicable)

a) formal carer lives with the Respondent	YES	NO
---	-----	----

b) during last month the Respondent received carer services approximately  
(please do not fill if you cannot remember) \_\_\_\_\_ times

c) usually visit lasted for \_\_\_\_\_ hours  
(please do not fill if you cannot remember)

#### 4 Health status

4.1 I rate Respondent's health status as: (please circle your response)

a) very poor    b) poor    c) fair    d) good    e) very good

4.2 The Respondent has health problems such as:

a) cardiovascular disease	YES	NO
---------------------------	-----	----

b) diabetes		YES	NO
1	1	1	1
2	1	1	1
3	1	1	1
4	1	1	1
5	1	1	1
6	1	1	1
7	1	1	1
8	1	1	1
9	1	1	1
10	1	1	1
11	1	1	1
12	1	1	1
13	1	1	1
14	1	1	1
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93	1	1	1
94	1	1	1
95	1	1	1
96	1	1	1
97	1	1	1
98	1	1	1
99	1	1	1
100	1	1	1

c) pulmonary disease	YES	NO
----------------------	-----	----

d) nervous system disease	YES	NO
---------------------------	-----	----

e) musculoskeletal system disease	YES	NO
-----------------------------------	-----	----

f) dizziness	YES	NO
--------------	-----	----

g) other ..... YES NO

## 4.3 The Respondent suffered from the following diseases in the past:

a) stroke	YES	NO
b) myocardial infarction	YES	NO
c) cancer (treatment completed, cancer perceived as cured)	YES	NO

## 4.4 The Respondent regularly uses the following devices for health or fitness monitoring:

a) blood pressure meter	YES	NO
b) personal scale	YES	NO
c) glucometer	YES	NO
d) oximeter	YES	NO
e) thermometer	YES	NO
f) other - please specify	YES	NO

.....

4.5 The Respondent takes medications prescribed by  
a doctor everyday

YES	NO
-----	----

## 4.6 The Respondent has disorders of balance and walk:

a) indoors	YES	NO
b) outdoors	YES	NO

## 4.7 The Respondent fell \_\_\_\_\_ times during last 12 months indoors

## 4.8 The Respondent fell \_\_\_\_\_ times during last 12 months outdoors

## 4.9 The Respondent uses the following equipment supporting walking:

a) walking stick	YES	NO
b) walker (walking frame)	YES	NO
c) crutches	YES	NO

## 4.10 The Respondent uses the following shoes indoors:

a) shoes with closed back	YES	NO
b) shoes with open back	YES	NO

## 4.11 Vision problems

a) The Respondent has vision problems affecting my daily life	YES	NO
b) The Respondent can read without glasses	YES	NO
c) The Respondent wears glasses for reading	YES	NO
d) The Respondent wears glasses for watching TV	YES	NO

## 4.12 Hearing problems

a) The Respondent has hearing problems affecting my daily life	YES	NO
--	-----	----

b) The Respondent has no problems with communication

without hearing aid

YES

NO

c) The Respondent has a hearing aid

YES

NO

d) The Respondent uses a hearing aid on regular basis

YES

NO

#### 4.13 Sleep

a) The Respondent usually goes to sleep at ..... in the evening (please specify the hour)

b) The Respondent usually wakes up at ..... in the morning (please specify the hour)

c) The Respondent has problems with sleep

YES

NO

d) The Respondent often takes sleep pills

YES

NO

e) The Respondent usually has to use the toilet during the night

YES

NO

#### 4.14 Mood

a) The Respondent often feels sad, tense, anxious

YES

NO

b) changes of Respondent's mood affect her/his daily life

YES

NO

### 5 Social relations

5.1 The Respondent meets with other people (socializes): (please circle your response)

a) everyday    b) once a week    c) several times a month    d) less than once a month

5.2 I think that the Respondent would like to socialize (please circle your response)

a) less    b) more    c) I do not want to change the current state    d) other

5.3 The Respondent uses the following forms of communication:

a) personal contact

YES

NO

b) phone calls

YES

NO

c) SMS (text message) exchange

YES

NO

d) internet communications (e.g. e-mails, social media)

YES

NO

### 6 IONIS system functions

The IONIS system will be equipped with many functions intended to support some of your activities and increase your safety. The proposed functions and remarks concerning their implementations are listed below

#### 6.1 Fall detection

In case of a fall the system will inform Respondent's carer:

a) I perceive this function as useful

YES

NO

b) I think that the Respondent would accept carrying

a small device for fall detection purposes

YES

NO

c) I think that the Respondent would accept

installing a small device in the house/flat

YES

NO

## 6.2 Finding items

a) The Respondent has some problems with finding

small items at home

YES

NO

If yes, she/he is usually looking for: (please circle the correct responses)

b) keys          c) phone          d) glasses

e) wallet          f) purse

g) other (please state) .....

## 6.3 The system will help the Respondent to find items in his/her home

a) I perceive this function as useful

YES

NO

b) I think that the Respondent would accept small

device attached to the item

YES

NO

c) I think that the Respondent would accept installing

a touchscreen and few small devices in the house/flat

YES

NO

## 6.4 Monitoring mobility

The function is intended for detection of situations indicating motor agitation ( e.g. anxiety, wandering). The system will collect and analyze information on Respondent's mobility. The system will inform the carer who will help to solve the problem.

a) I perceive this function as useful

YES

NO

b) I think that the Respondent would accept carrying

a small device for mobility monitoring

YES

NO

c) I think that the Respondent would accept installing

a few small devices in the house/flat

YES

NO

## 6.5 Localization outdoors

The function is intended to determine Respondent's localization during walking, shopping. In case the Respondent forgets to find his/her way home the system will inform the carer on his/her localization.

a) I perceive this function as useful

YES

NO

b) I think that the Respondent would accept carrying

a small device for outdoor localization and communication

YES

NO

## 6.6 Sleep quality monitoring

The system will measure breath rate and detect your movements when the Respondent sleeps. Gathered data will be used for detection of sleep problems and could help to solve them.

a) I perceive this function as useful

YES

NO

b) I think that the Respondent would agree to use it

YES

NO

c) I think that the Respondent would accept bracelet like device

YES

NO

d) I think that the Respondent would accept placing a small

device close to my bed or a small device attached to the bed

YES

NO

- e) I think that the Respondent would accept switching the monitor device on in the evening and switching it off in the morning
- |     |    |
|-----|----|
| YES | NO |
|-----|----|

#### 6.7 Health monitoring

The system based on a smartwatch ( a device equipped with sensors worn as a wristwatch) will investigate Respondent's balance and detect change in your health

- |   |     |    |
|---|-----|----|
| a) I perceive this function as useful   | YES | NO |
| b) I think that the Respondent would agree to use it                                      | YES | NO |
| c) I think that the Respondent would accept a device of watch size, worn on her/his wrist | YES | NO |

6.8 The system is also able to collect results from devices used for health related parameters measurements (e.g. blood pressure meter, personal scale, glucometer, oximeter, thermometer, pulse meter)

- |                                       |     |    |
|---------------------------------------|-----|----|
| a) I perceive this function as useful | YES | NO |
|---------------------------------------|-----|----|

#### 6.9 Personalized calendar

The system will remind the Respondent about planned activities, events and important dates (e.g. relative's or friend's birthday). Personalized calendars for the current day with important agenda will be visible on tablet, computer or TV.

- |   |     |    |
|---|-----|----|
| a) I perceive this function as useful               | YES | NO |
| b) I think that the Respondent would like to use it | YES | NO |

#### 6.10 Medication reminders

The system will remind the Respondent about medicines he/she has to take. Medication reminders will be visible on tablet, computer or TV send in SMS message to the phone, played as a vocal reminder.

- |  |     |    |
|--|-----|----|
| a) I perceive this function as useful                                | YES | NO |
| b) I think that use of e-mail for this purpose is useful             | YES | NO |
| c) I think that use of SMS for this purpose is useful                | YES | NO |
| d) I think that use of web site interface for this purpose is useful | YES | NO |
| e) I think that use of voice message for this purpose is useful      | YES | NO |

6.11 Most of system functions require use of an additional, small (book sized) device collecting and processing results from sensors.

- I think that the Respondent would accept installing such device in the house/flat - the total energy consumed by devices is at least two times lower than consumed by a standard refrigerator)
- |     |    |
|-----|----|
| YES | NO |
|-----|----|

## 7 Technology acceptance

The Respondent uses the following devices: (please circle your response)

- |     |              |          |           |          |
|-----|--------------|----------|-----------|----------|
| 7.1 | mobile phone | a) often | b) seldom | c) never |
| 7.2 | smartphone   | a) often | b) seldom | c) never |
| 7.3 | tablet       | a) often | b) seldom | c) never |
| 7.4 | computer     | a) often | b) seldom | c) never |

7.5 TV set with a remote controller a) often b) seldom c) never

The Respondent uses a smartphone/tablet/computer for the following activities: (please circle your response)

7.6 Reading and writing emails a) often b) seldom c) never

7.7 Internet access a) often b) seldom c) never

7.8 Playing games a) often b) seldom c) never

## 8 Costs of services (informal Carers only)

### 8.1 Payment options

a) I would accept paying for technical assistance services and devices	YES	NO
b) I expect including payment as a part of health insurance	YES	NO
c) I expect funding by public sector	YES	NO

### 8.2 I prefer the following solutions:

a) buying the equipment or part of it	YES	NO
b) renting the equipment and paying fee every month	YES	NO

### 8.3 In case of monthly fee:

a) I would accept the fee lower than phone subscription	YES	NO
b) I would accept the fee higher than phone subscription	YES	NO

8.4 In case of health monitoring devices (e.g. blood pressure meter, scale, glucometer, oximeter, thermometer) I would accept to pay more for a smart health monitoring device (e.g. device that can be connected to the IONIS platform) as compared to a classical device	YES	NO
--	-----	----

If I would accept paying:

a) 5-20 Euro more    b) 30-60 Euro more    c) 70-100 Euro more

## 9 Demographic data

9.2 Respondent's age (in yrs) \_\_\_\_\_

9.3 Respondent's gender    a) male    b) female

## QUESTIONNAIRE PART TO BE FILLED BY THE INTERVIEWER

9.1 Questionnaire code \_\_\_\_\_

## 8 Document History

Date	Changes	Version	Author
31.07.2018	Table of contents initialized	0.1	WUT
21.11.2018	First document version with all partners contributions	1.0	WUT
29.11.2018	Final peer reviewed version of the report	2.0	WUT

- End of document -