HOPE Project
AAL-2008-1-099
Smart Home for Elderly People

Assessment and Evaluation Report

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Introduction

The objective of this deliverable is to present the HOPE Assessment and Evaluation Report. This document presents the results of the end users' assessment questionnaires from 7 different pilot sites (1 in Spain, 5 in Greece and 1 in Italy).

The Overall Evaluation Strategy in HOPE

Evaluation Procedures in Pilots

Italian Pilot

The Italian pilot was deployed in one apartment of the home retirement owned and managed by the Hospital "Casa Sollievo della Sofferenza" (IRCSS) called "Casa di Riposo Padre Pio", located in San Giovanni Rotondo (FG), near the Hospital. Researchers choose this location because the apartment were near the Hospital, the patient is one already under medical cares done by the Hospital, the apartment were of middle dimensions and well equipped to install all devices needed for the project.

The installation were started with a minimal system (the PC, the ZigBee coordinator and a move sensor) the 15th November 2010. Since then, different

improvements were achieved, especially the add of new sensors, until the final configuration. The system were running until the end of the project in July 2011.

The services deployed in the apartment were:

- Local Logging.
- Scenario Assessment.
- Alarm Service.
- Synchronization Service.
- Patient System Interaction (voice message to patient).
- Short Messages Service (SMS) Service.

And the devices installed were:

- 1x Ubee, one ZigBee devices coordinator.
- 2x ZRC, two temperature sensors, one for the interiors and one for the exteriors.
- 2x ZMove, Passive Infrarred Sensor (PIR) to detect people movement.
- 1x ZDoor, one intrusion detector to verify that the door is closed correctly.
- 1x ZPlug, one energy monitor and remote switch for wall plug.

Spanish Pilot

The Spanish pilot was made in the retirement home Rio Holanda from 14th September 2010 to 20 June 2011. Rio Holanda retirement home is located in Benalmadena, a village on the southern coast of Spain. There are several reasons to choose this residence:

- A factor to consider was that patients had different nationalities in addition to Spanish nationality.
- Being a small residence with few places, its employees are very close to the patients and can better see the impact of the pilot in them.

The services finally deployed in Rio Holanda retirement home were:

- Local Logging.

- Scenario Assessment.
- Alarm Service.
- Synchronization Service.
- Patient System Interaction (voice message to patient).
- Short Messages Service (SMS) Service.

And the devices finally installed were:

- 1x Ubee, one ZigBee devices coordinator.
- 2x ZRC, two temperature sensors.
- 1x ZMove, one Passive Infrarred Sensor (PIR) to detect people movement.
- 1x ZDoor, one intrusion detector to verify that the door is closed correctly.
- 1x ZGas, one gas detector.
- 1x ZPlug, one energy monitor and remote switch for wall plug.

Other devices were planned like the ZCare, a fall and pulse detector, but due to several problems whit it (see below

Lessons learned ***page 14***).

The following table describes evaluation date and results of each service:

Evaluated service	Evaluation date/period
Local Logging	September 2010 to 20 June 2011 Results: All devices' measures have been stored during the pilot with the exception of a few days due to maintenance tasks and internet connection problems.
Scenario Assessment	September 2010 to 20 June 2011 Results: Have been tested all possible scenarios and in all cases the suitable actions have been carried out locally or remotely as expected.
Alarm Service	September 2010 to 20 June 2011 Results: Have been defined several types of alarms including all devices installed in the pilot. The result has been satisfactory; the alarms have been recorded in the database and have been showed in the Alarm Client application.
Synchronization Service	September 2010 to 20 June 2011 Results: The synchronization between the local machine and remote host has been successful with a very low latency, consumption of bandwidth and CPU usage. Some days the synchronization has not been produced due to problems with internet connection.
Patient System Interaction	September 2010 to 20 June 2011 Results: When an alarm has been triggered the reminders associated with it has been reproduced by the speaker. Some patients were surprised when heard the reminders the first time, but then have become accustomed to listen them and in most cases the recommendations have been carried out, in particular the need to drink water in the warmer months.
SMS Service	September 2010 to 20 June 2011 Results: There was no problem with the reception of SMS: The caregivers has received the messages on time and not have been any delays or delivery failures.

Greek Pilot

There were 5 pilot installations in Greece, 3 of them located in Athens and 2 of them located in Rhodes Island. All users were in the first stage of the Alzheimer disease, 4 of them living alone and the other with his family.

Listing of services tested in each pilot site

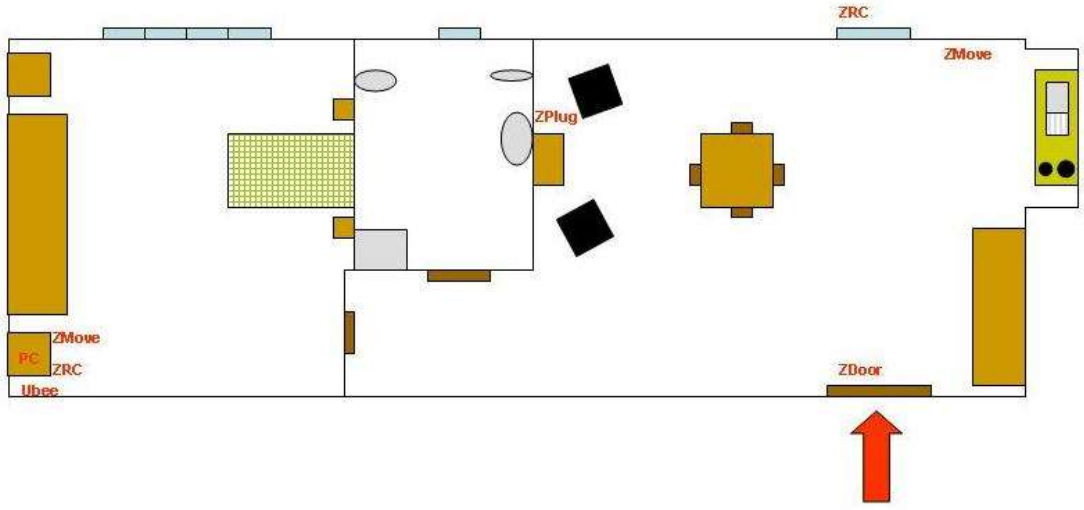
Country	Services	Zigbee devices
Italy	• Local Logging • Scenario Assessment • Alarm Service • Synchronization Service • Audio Messages Application • SMS Service	1x Ubee 2x ZRC 2x ZMove 1x ZDoor 1x ZPlug
Spain	• Local Logging • Scenario Assessment • Alarm Service • Synchronization Service • Audio Messages Application • SMS Service	1x Ubee 2x ZRC 1x ZMove 1x ZDoor 1x ZGas 1x ZCare 1x ZPlug
Greece Pilot 1	• Local Logging • Synchronization Service • Scenario Assessment • Audio Messages Application • SMS Service	1x Ubee 2x ZRC 1x ZMove 1x ZDoor 1x ZGas 1x ZPlug
Greece Pilot 2	• Local Logging • Synchronization Service • Scenario Assessment • Audio Messages Application • SMS Service	1x Ubee 2x ZRC 1x ZMove 1x ZDoor 1x ZGas 1x ZPlug
Greece Pilot 3	• Local Logging • Synchronization Service • Scenario Assessment • Audio Messages Application • SMS Service	1x Ubee 2x ZRC 1x ZMove 1x ZDoor 1x ZGas 1x ZPlug 1x Zcare
Greece Pilot 4	• Local Logging • Synchronization Service • Scenario Assessment • Patient System Interaction (voice message to patient)	1x Ubee 2x ZRC 1x ZMove 1x ZDoor 1x ZCare 1x ZGas

Country	Services	Zigbee devices
	• SMS Service	1x ZPlug 1x Zcare
Greece Pilot 5	• Local Logging • Synchronization Service • Scenario Assessment • Patient System Interaction (voice message to patient) • SMS Service	1x Ubee 2x ZRC 1x ZMove 1x ZDoor 1x ZCare 1x ZGas 1x ZPlug 1x Zcare

End Users Assessment

Italian Pilot

The system was easily deployed in the apartment as in the figure below:



The devices monitor the bedroom (the one on the left side) and the living room (on the right side). ZRC are placed one in the bedroom to monitor the internal temperature and one out the living room window, to monitor the external temperature. The ZDoor on the main door controls the open/close signals. The ZPlug in the living room act both as a router for the zigbee signals and as a switch for the electrical devices plugged in.

Description of evaluation process in the Italian pilot
Introduction

For elderly people, home is a place of memories where they spend most of their time. Their needs increase and change with growing age - especially when their health status starts to worsen. Patients with cognitive impairment represent a frail population with specific needs that require time and resources to be assisted. The creation of useful instrument to assist these subjects is an imperative for the entire society considering the social and economic impact of this disease.

Taking into account the complexity of this population is essential to design the entire project and in detail every phase. So it's necessary to involve subjects and their caregiver actively from the start of the project. This could led to a reduction of the possibility of developing an instrument not useful and not responding to the specific issues of these kind of patients. Another aspect to be considered is the lack of standardized method to evaluate the outcomes in the applications of this technology.

The application of standardized instrument validated and widely used in other settings giving clear results could partially permit to increase the possibility of comparison of the data and is the base to create new instruments to capture more specific outcome.

Evaluation procedures:

Every subject prior of entering in the study signed an informed consent in which was clearly interference with the daily life and data use. Subjects had the possibilities of retire from the study in every moment without notice. Thereafter, we administered a test battery including a standardized comprehensive geriatric assessment (CGA) using validated instruments to evaluate the functional, cognitive and affective status and other tools to evaluate more specific aspects like the quality of life and service satisfaction. The choice of widely validated instruments administrable not exclusively from a medical worker and, giving for every aspect assessed a numeric result, gave us the opportunity of retrieving more clear results in term of accuracy and comprehensiveness. In this area doesn't exist a standard to evaluate a specific intervention so the use of standardized instruments could improve the knowledge of the impact of this technology on different domains that affect the life of an older subject. This could lead to develop and realize a system that is more close to the real need of this population improving autonomy and quality of life. At six months from the

installation the complete test battery was repeated and data were statistically processed. All the data were collected from a psychologist involved in the study visiting directly the subject.

In detail the test battery included the following tools: A standardized Comprehensive Geriatric Assessment (CGA) that is a multidimensional evaluation that examines medical, psychological, social, and environmental components, as well as functional and cognitive components. A CGA was carried out using assessment instruments widely employed in geriatric practice. Functional status was evaluated by activities of daily living (ADL) index[i], and by instrumental activities of daily living (IADL) scale[ii]. Comorbidity was examined using the Cumulative Illness Rating Scale (CIRS)[iii]. Nutritional status was explored with the mini nutritional assessment (MNA)[iv]. The Exton-Smith Scale (ESS)[v] was used to evaluate the risk of developing pressure sores. Medication use was defined according to the Anatomical Therapeutics Chemical Classification code system, and the number of drugs used by patients at admission was recorded. Social aspects included household composition, home service, and institutionalization. Cognitive status was evaluated using the Short Portable Mental Status Questionnaire (SPMSQ), a 10-item questionnaire that assesses orientation, memory, attention, calculation, and language.[vi] From all the above data was calculated the Multidimensional Prognostic Index (MPI)[vii] a tool that appear useful in many disease[viii,ix,x] including dementia[xi], estimating with accuracy prognosis and dynamic changing in the health state.

Hamilton Rating Scale for Depression (HAM-D)[xii], one of the most commonly used scales for rating depression in medical research, is a multiple choice questionnaire that rates the severity of a patient's major depression. Geriatric Depression Scale (GDS)[xiii], is a 30-item self-report assessment designed specifically to identify depression in the elderly. Neuropsychiatric Inventory (NPI)[xiv] and Care Giver Burden (CGB) are evaluation tools for the patient and the caregiver and/or relative that evaluate neuropsychiatric domains (delusions, hallucinations, agitation/aggression, depression mood, anxiety, euphoria, apathy, disinhibition, irritability/lability, aberrant motor activity, sleep disturbance, and eating disorder) and care-giver burden. Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q)[xv], a self-report measure designed to easily obtain sensitive measures of the degree of enjoyment and satisfaction experienced by subjects in various areas of daily functioning.

Results of initial evaluation:

The preliminary results collected during the testing phase are prevalently subjective regarding the acceptance and tolerance of the subjects during the experimentation. Consist of data collected from telephonic interviews performed every two weeks. These data are encouraging showing that subjects tolerate ICT use in their home and are really interested in its developing. They feel more secure and are open to try different solutions that could prolong, much more is possible, their life at home. Gave suggestions and interesting comments to the work done, permitting a more fine tuning and offered ideas about the further develop. Moreover had really great expectations from the use technologies.

Results

After the end of the experimentation the two end users involved showed an improvement on MPI score (5%); ADL (3.5%); IADL (2.8%); MNA (13.3%); Exthon-Smith scale (2.7%); MMSE (1.45); HAM-D score (24.55%); GDS score (25.67%), NPI score (13.22%) and CGB (11.78%). No improvements were showed on CIRS and in the number of drugs taken.

Also they showed an improvement of 47.89% on the Q-LES-Q score. The clear limitation of this data is bounded to the sample size that consists of two installed prototype so a generalization of this data are not possible. Although these data are promising and further randomized multicenter study could confirm these results.

Spanish Pilot

The devices were installed in one of living room where residents spend considerable time daily, detailed below an outline of the distribution and location of the devices.

Figure 1: **Location of devices in Spanish pilot, 3D Recreation**

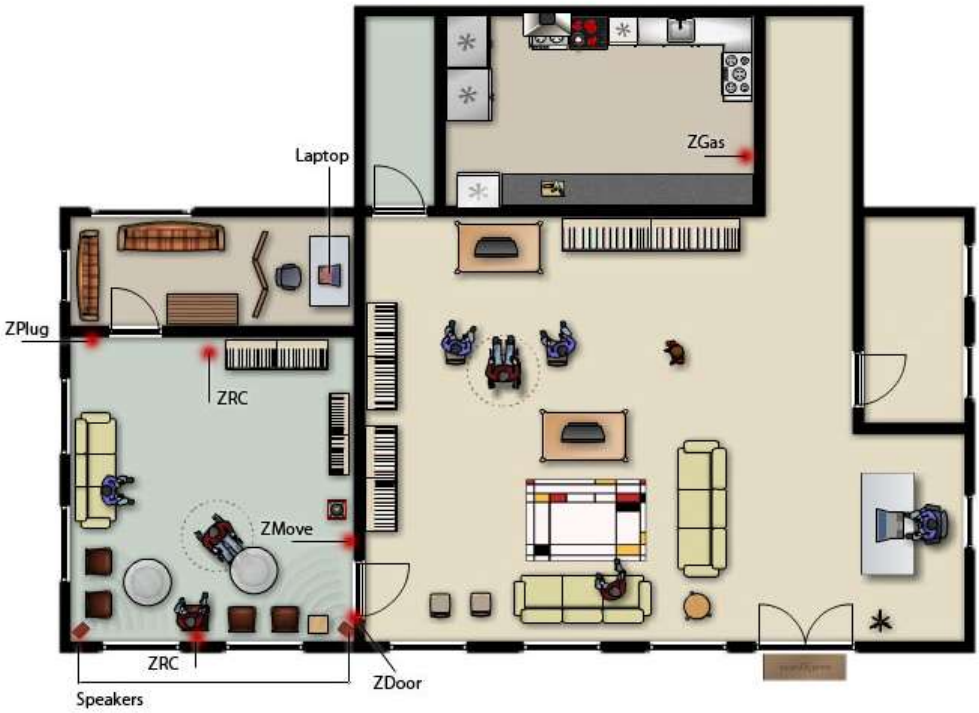


Figure 2: **Location of devices in Spanish pilot, 2D Recreation**

Greek Pilot

Description of evaluation process in the Greek pilot

Every subject prior to entering in the study signed an informed consent in which was clearly explained the project finality with information about the duration, health risk, the possible interference with the daily life and data use. Subjects have the possibilities of retirement from the study in every moment without notice.

Every two weeks, the subjects are contacted by an operator to assess trouble, counsel, and to give eventually explanations on the functioning of the system. The subject, although, could contact every day an operator to signal any trouble or problem related to the system. At the end of the project a questionnaire was distributed to all pilot sites in order to assess the functionality of the system. All the data were collected from a medical or social worker involved in the study either by visiting directly the subject or through a phone call.

Lessons learned

Italy

Implementation of smart home for elderly people in patients with mild cognitive impairment is promising. This kind of application is accepted and is feasible with relative low cost considering the technologies used. Moreover we need to develop interface more user friendly and modular to tight specific answers considering the wide diversity of the elderly population on socio-economic, regional and national basis. Another question to address is to determine if this solution could improve the life of patients with more cognitive decline and to what degree could reduce the need of care and consequently the economic impact for the parent network. Clearly this aspect is really important in the resource distribution of national and regional health system.

Guideline for the user and caregiver: No specific advise was developed. A psychologist informed the subjects involved in the study on all the information needed regarding the study, the data use and system safety and maintenance.

Technology point of view: During the research activities a set of issues were solved and important tips to work with the HOPE system are here detailed. First, a reliable power supply is important to assure a 24h/24 service running, so an UPS is suggested. It is important to have available a set of batteries to install all the sensors (2 batteries each). The internet connection should to be with a static IP address therefore, for new connections, it is important to highlight this point to the telecom operator because the default activation is with a dynamic IP address. Finally, the number of installation sessions should to be minimized in order to be less intrusive in the patient's private life.

Spain

In this section there is a compilation of all the lessons learned during the pilot phase.

ZGas's low battery warning

All ZigBee devices including ZGas send a message when the device has low battery, the threshold that causes the device sends low-battery warning is lower than the value used by ZGas to start beeping. This causes the patient's carer wasn't reported on time by the system to replace the battery before ZGas starts beeping, disturbing the patient.

Speakers interferences

The installation of wireless speakers is easy and makes all connections are wireless. Our speakers use FM technology to transmit sound, so sometimes were heard FM radio broadcasting in the system's speakers. These interferences disturbed to patients and, in addition, may cause a message not be heard properly by them.

Zigbee Device Association

If the power failed and Ubee is out of power as well its association with the Zigbee devices is lost. When power returns, the devices are automatically associated with it, although this operation is not successful in all cases. In this case the patient's carer must manually associate the devices that have not been able to reconnect.

ZCare is not waterproof

Although ZCare device is very useful to check the health of the patient, it is not that comfortable to use it. Due to the fact that the device is not water resistant, it is necessary to take it off every time the patient needs to take a shower or doing any activity that requires wetting his/her wrists. Whenever patient take off or wear the Zcare, it is necessary to disable or enable it manually in order to not send false alarms while not wear it or not send alarms while wear it. This makes the patient or caregiver must pay attention to deactivate or activate the ZCare properly.
For further studies/projects we propose to change the ZCare for another device with the same functionalities but water resistant to allow patient can wear it permanently without having to take off.

Add a redundant internet connection.

Internet connection it is a crucial point because some services require that the machine is reachable from the outside, allows the remote administration (so in case of failure it is not possible to access from the outside). A redundant connection must be a 3G modem to use when the Ethernet o Wi-Fi connection fails.

Include an UPS

The pilot did not include any Uninterrupted Power System (UPS), should have included one in order to prevent blackouts and keeping services actives all the time.

Test the system in a living lab prior to the pilot.

If we had tested the system in a living lab prior to pilot most of the problems would have been detected and corrected early. There are many failures difficult to detect at the stage of development, but easy to detect in a living lab.

Greece

During the pilot testing phase of the project the consortium faced several technical problems most of them related to the nature of the sensors.

Coverage of the Zigbee Network

The technicians responsible for the installation of the sensors had to come up with a backup plan as far as the installation process is concerned, due to the limited coverage of the Zigbee network. Although the technical specifications of the selected sensors referred that their coverage was about 30m, in reality this was no more that 5 m. This caused inconvenience in the installation process and sometimes even if at the beginning it seemed that the sensors worked properly, a few hours after the completion of the installation the sensors could not send any data.

Use static IP in the pilot site

Internet connection is a crucial point because some services require that the machine be reachable from the outside, allowing the remote administration. Moreover the IP must be static in order to reassure the access to the central HOPE server, which has a limited access list for security purposes. Some of the clients did not use static IP and this delayed their synchronisation process.

Battery consumption of ZCare and ZGas

Albeit the manual and the technical specifications of ZCare and ZGas refer that a battery change is needed every 6 months, ZGas started beeping 2 weeks after the installation, annoying the elder. The consortium faced the same problem with the ZCare sensor during its testing process.

ZCare is not waterproof and demands technical skills difficult to find among elders

Due to the fact that the device is not water resistant, it is necessary to take it off every time the patient needs to take a shower or doing any activity that requires wetting his/her wrists. In these cases, in order to avoid fake alarms it is necessary to disable and then enable it again manually by pressing a button for a specified number of seconds. This can make the patient get confused easily, not being able to understand if the bracelet is on or off.

Conclusion

We demonstrated that the use of the HOPE system can improve the functional, nutritional, cognitive, affective and neuropsychiatric state of subject with mild cognitive impairment. The MPI index improve, too, suggesting an improving in the mortality trend. Furthermore, the smart home affects, also, the subject's satisfaction and quality of life. These results at six months are encouraging. Increase the resources in this experimentation represent a valid option to improve the system and technology used and perform a more large experimentation to obtain data more significant and applicable in different settings. This latter aspect is needed to permit an application of these technologies on large scale. In fact the data collected are of limited value considering the relatively short follow-up and sample size. A correct application of these technologies could permit to maintain an acceptable quality of life at sustainable cost for the society so first will be able to create useful system and first we'll obtain the ambitious objective of prolong life at home increasing autonomy and quality of life.

End user questionnaires

First end-user questionnaire:

End User Questionnaire V1.0

1. **Please indicate your status (select one only):**

Elderly		Comments:
Relative	√	
Caregiver		
Other		

2. **Select the devices that are installed in the house (select all that apply):**

PC/Laptop & wireless sensor controller	√	Comments:
Open/Closed Door sensor	√	
Temperature sensor	√	
Movement/presence sensor	√	

Fall Detection sensor/bracelet		Comments:
Pulse sensor/bracelet		
Panic Button/bracelet		
SMS / 3G module		

Plug sensor	√	Comments:
Gas leak sensor	√	
Camera		
Touch Screen		
Microphone		
Speakers	√	

3. **Select the services that are installed in the house (select all that apply):**

Elderly System Interaction (voice messages)	√	Comments:
Short Messages Service (SMS) Service	√	
Video Conference Applications		
Web / Client Interfacing system	√	

4. **Select the scenarios that are operational in the house (select all that apply):**

Main door open for a given period of time	√	Comments:
Temperature is above/below a threshold	√	
Pulse is above/below a threshold		
Panic/Alarm Communication Button –bracelet		
Fall Detection / bracelet		
Elderly is alone at home for a given period of time	√	
Gas leak detection alarm	√	
A device is on/off	√	

5. **Were you involved in decisions about the home care service in terms of the following (select all that apply):**

Which scenarios to be operational	√	Comments:
How you wanted them to notify	√	
The period the system was operational	√	
The daily hours the system was operational	√	

6. **How satisfied are you with the HOPE system(select only one):**

I am extremely satisfied		Comments:
I am quite satisfied	√	
I am neither satisfied nor dissatisfied		
I am quite dissatisfied		
I am extremely dissatisfied		
I don't know/ no comment		

7. **Was the HOPE Alarm Service efficient when needed (select only one)::**

It always was efficient when needed	√	Comments:
It sometimes was efficient when needed		
It never was efficient when needed		
I don't know/ no comment		

8. **To what extent has the service you received improved the following:**

	Strongly Agree	Agree	Not sure	Disagree
The quality of life	√			
Your own health and well-being		√		
Relationship with your family & you		√		
Feeling safe & secure	√			

9. **Does the HOPE system improve the relationships with the elderly, family and caregiver? (select only one)::**

Always	√	Comments:
Usually		
Some times		
Never		
I don't know / no comment		

10. **In your opinion, which of the following statements best fits the support you receive (select only one):**

HOPE system always manages to support me fully when needed	√	Comments:
HOPE system usually manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
I don't know / no comment		

11. **To what extend you agree with the following statements:**

	Strongly Agree	Agree	Not sure	Disag ree
The HOPE system makes me feel safer	√			
The HOPE system makes me feel more independent		√		

The HOPE system may reduce the caregiver-related costs		√		

12. Does the elderly receive any practical help from friends, neighbors or family members (select one only)?

Yes, from someone living in my household	
Yes, from someone living in another household	√
No	

13. How long HOPE System was operational (select one only)?

Less than 3 months	
3 months to 6 months	
More than 6 months	√
I don't know / no comment	

14. Please comment for any changes needed in the current HOPE System functionality

Comments:

The use of these devices is clearly an innovation and seems very helpful for the elderly

15. Please comment for any enhancements in HOPE System functionality in the future versions

Comments:
Tracking devices placed on the patient in order to find him if he's lost

16. Are you male or female:

Male	
Female	√

17. How old are you:

Under 60	√
60-74	
75-84	
85+	

Thank you for taking the time to helps us improve HOPE System

Second end-user questionnaire:

End User Questionnaire V1.0

1. **Please indicate your status (select one only):**

Elderly		Comments:
Relative	√	
Caregiver		
Other		

2. **Select the devices that are installed in the house (select all that apply):**

PC/Laptop & wireless sensor controller	√	Comments:
Open/Closed Door sensor	√	
Temperature sensor	√	
Movement/presence sensor	√	

Fall Detection sensor/bracelet		Comments:
Pulse sensor/bracelet		
Panic Button/bracelet		
SMS / 3G module		

Plug sensor	√	Comments:
Gas leak sensor	√	
Camera		
Touch Screen		
Microphone		
Speakers	√	

3. **Select the services that are installed in the house (select all that apply):**

Elderly System Interaction (voice messages)	√	Comments:
Short Messages Service (SMS) Service	√	
Video Conference Applications		
Web / Client Interfacing system	√	

4. **Select the scenarios that are operational in the house (select all that apply):**

Main door open for a given period of time	√	Comments:
Temperature is above/below a threshold	√	
Pulse is above/below a threshold		
Panic/Alarm Communication Button –bracelet		
Fall Detection / bracelet		
Elderly is alone at home for a given period of time	√	
Gas leak detection alarm	√	
A device is on/off	√	

5. **Were you involved in decisions about the home care service in terms of the following (select all that apply):**

Which scenarios to be operational	√	Comments:
How you wanted them to notify	√	
The period the system was operational	√	
The daily hours the system was operational	√	

6. **How satisfied are you with the HOPE system(select only one):**

I am extremely satisfied		Comments:
I am quite satisfied	√	
I am neither satisfied nor dissatisfied		
I am quite dissatisfied		
I am extremely dissatisfied		
I don't know/ no comment		

7. **Was the HOPE Alarm Service efficient when needed (select only one)::**

It always was efficient when needed		Comments:
It sometimes was efficient when needed	√	
It never was efficient when needed		
I don't know/ no comment		

8. **To what extent has the service you received improved the following:**

	Strongly Agree	Agree	Not sure	Disagree
The quality of life		√		
Your own health and well-being		√		
Relationship with your family & you		√		
Feeling safe & secure	√			

9. **Does the HOPE system improve the relationships with the elderly, family and caregiver? (select only one)::**

Always	√	Comments:
Usually		
Some times		
Never		
I don't know / no comment		

10. **In your opinion, which of the following statements best fits the support you receive (select only one):**

HOPE system always manages to support me fully when needed	√	Comments:
HOPE system usually manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
I don't know / no comment		

11. **To what extend you agree with the following statements:**

	Strongly Agree	Agree	Not sure	Disag ree
The HOPE system makes me feel safer	√			
The HOPE system makes me feel more independent		√		

The HOPE system may reduce the caregiver-related costs			√	

12. Does the elderly receive any practical help from friends, neighbors or family members (select one only)?

Yes, from someone living in my household	
Yes, from someone living in another household	√
No	

13. How long HOPE System was operational (select one only)?

Less than 3 months	
3 months to 6 months	√
More than 6 months	
I don't know / no comment	

14. Please comment for any changes needed in the current HOPE System functionality

Comments:

15. Please comment for any enhancements in HOPE System functionality in the future versions

Comments:

16. Are you male or female:

Male	
Female	√

17. How old are you:

Under 60	
60-74	√
75-84	
85+	

Thank you for taking the time to helps us improve HOPE System

Third end-user questionnaire:

End User Questionnaire V1.0

1. **Please indicate your status (select one only):**

Elderly		Comments:
Relative	√	
Caregiver		
Other		

2. **Select the devices that are installed in the house (select all that apply):**

PC/Laptop & wireless sensor controller	√	Comments:
Open/Closed Door sensor	√	
Temperature sensor	√	
Movement/presence sensor	√	

Fall Detection sensor/bracelet		Comments:
Pulse sensor/bracelet		
Panic Button/bracelet		
SMS / 3G module		

Plug sensor	√	Comments:
Gas leak sensor	√	
Camera		
Touch Screen		
Microphone		
Speakers	√	

3. **Select the services that are installed in the house (select all that apply):**

Elderly System Interaction (voice messages)	√	Comments:
Short Messages Service (SMS) Service	√	
Video Conference Applications		
Web / Client Interfacing system	√	

4. **Select the scenarios that are operational in the house (select all that apply):**

Main door open for a given period of time	√	Comments:
Temperature is above/below a threshold	√	
Pulse is above/below a threshold		
Panic/Alarm Communication Button –bracelet		
Fall Detection / bracelet		
Elderly is alone at home for a given period of time	√	
Gas leak detection alarm	√	
A device is on/off	√	

5. **Were you involved in decisions about the home care service in terms of the following (select all that apply):**

Which scenarios to be operational	√	Comments:
How you wanted them to notify	√	
The period the system was operational	√	
The daily hours the system was operational	√	

6. **How satisfied are you with the HOPE system(select only one):**

I am extremely satisfied		Comments:
I am quite satisfied		
I am neither satisfied nor dissatisfied	√	
I am quite dissatisfied		
I am extremely dissatisfied		
I don't know/ no comment		

7. **Was the HOPE Alarm Service efficient when needed (select only one)::**

		Comments:
It always was efficient when needed		
It sometimes was efficient when needed	√	
It never was efficient when needed		
I don't know/ no comment		

8. **To what extent has the service you received improved the following:**

	Strongly Agree	Agree	Not sure	Disagree
The quality of life			√	
Your own health and well-being			√	
Relationship with your family & you		√		
Feeling safe & secure	√			

9. **Does the HOPE system improve the relationships with the elderly, family and caregiver? (select only one)::**

		Comments:
Always		
Usually	√	
Some times		
Never		
I don't know / no comment		

10. **In your opinion, which of the following statements best fits the support you receive (select only one):**

		Comments:
HOPE system always manages to support me fully when needed		
HOPE system usually manages to support me fully when needed	√	
HOPE system sometimes manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
I don't know / no comment		

11. **To what extend you agree with the following statements:**

	Strongly Agree	Agree	Not sure	Disag ree
The HOPE system makes me feel safer	√			
The HOPE system makes me feel more independent	√			

The HOPE system may reduce the caregiver-related costs			√	

12. **Does the elderly receive any practical help from friends, neighbors or family members (select one only)?**

Yes, from someone living in my household	√
Yes, from someone living in another household	
No	

13. **How long HOPE System was operational (select one only)?**

Less than 3 months	
3 months to 6 months	√
More than 6 months	
I don't know / no comment	

14. **Please comment for any changes needed in the current HOPE System functionality**

Comments:

15. **Please comment for any enhancements in HOPE System functionality in the future versions**

Comments:

16. **Are you male or female:**

Male	√
Female	

17. **How old are you:**

Under 60	√
60-74	
75-84	
85+	

Thank you for taking the time to helps us improve HOPE System

Fourth end-user questionnaire:

End User Questionnaire V1.0

1. **Please indicate your status (select one only):**

Elderly		Comments:
Relative	√	
Caregiver		
Other		

2. **Select the devices that are installed in the house (select all that apply):**

PC/Laptop & wireless sensor controller	√	Comments:
Open/Closed Door sensor	√	
Temperature sensor	√	
Movement/presence sensor	√	

Fall Detection sensor/bracelet	√	Comments:
Pulse sensor/bracelet	√	
Panic Button/bracelet	√	
SMS / 3G module		

Plug sensor	√	Comments:
Gas leak sensor	v	
Camera		
Touch Screen		
Microphone		
Speakers	√	

3. **Select the services that are installed in the house (select all that apply):**

Elderly System Interaction (voice messages)	√	Comments:
Short Messages Service (SMS) Service	√	
Video Conference Applications		
Web / Client Interfacing system	√	

4. **Select the scenarios that are operational in the house (select all that apply):**

Main door open for a given period of time	√	Comments:
Temperature is above/below a threshold	√	
Pulse is above/below a threshold	√	
Panic/Alarm Communication Button –bracelet	√	
Fall Detection / bracelet	√	
Elderly is alone at home for a given period of time	√	
Gas leak detection alarm	√	
A device is on/off	√	

5. **Were you involved in decisions about the home care service in terms of the following (select all that apply):**

Which scenarios to be operational	√	Comments:
How you wanted them to notify	√	
The period the system was operational	√	
The daily hours the system was operational	√	

6. **How satisfied are you with the HOPE system(select only one):**

I am extremely satisfied	√	Comments:
I am quite satisfied		
I am neither satisfied nor dissatisfied		
I am quite dissatisfied		
I am extremely dissatisfied		
I don't know/ no comment		

7. **Was the HOPE Alarm Service efficient when needed (select only one)::**

It always was efficient when needed	√	Comments:
It sometimes was efficient when needed		
It never was efficient when needed		
I don't know/ no comment		

8. **To what extent has the service you received improved the following:**

	Strongly Agree	Agree	Not sure	Disagree
The quality of life	√			
Your own health and well-being		√		
Relationship with your family & you		√		
Feeling safe & secure	√			

9. **Does the HOPE system improve the relationships with the elderly, family and caregiver? (select only one)::**

Always		Comments:
Usually		
Some times	√	
Never		
I don't know / no comment		

10. **In your opinion, which of the following statements best fits the support you receive (select only one):**

HOPE system always manages to support me fully when needed	√	Comments:
HOPE system usually manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
I don't know / no comment		

11. **To what extend you agree with the following statements:**

	Strongly Agree	Agree	Not sure	Disag ree
The HOPE system makes me feel safer	√			
The HOPE system makes me feel more independent	√			

The HOPE system may reduce the caregiver-related costs		√		

12. **Does the elderly receive any practical help from friends, neighbors or family members (select one only)?**

Yes, from someone living in my household	
Yes, from someone living in another household	√
No	

13. **How long HOPE System was operational (select one only)?**

Less than 3 months	
3 months to 6 months	√
More than 6 months	
I don't know / no comment	

14. **Please comment for any changes needed in the current HOPE System functionality**

Comments:

15. **Please comment for any enhancements in HOPE System functionality in the future versions**

Comments:

16. **Are you male or female:**

Male	
Female	√

17. **How old are you:**

Under 60	√
60-74	
75-84	
85+	

Thank you for taking the time to helps us improve HOPE System

Fifth end-user questionnaire:

End User Questionnaire V1.0

1. **Please indicate your status (select one only):**

Elderly		Comments:
Relative	√	
Caregiver		
Other		

2. **Select the devices that are installed in the house (select all that apply):**

PC/Laptop & wireless sensor controller	√	Comments:
Open/Closed Door sensor	√	
Temperature sensor	√	
Movement/presence sensor	√	

Fall Detection sensor/bracelet	√	Comments:
Pulse sensor/bracelet	√	
Panic Button/bracelet	√	
SMS / 3G module		

Plug sensor	√	Comments:
Gas leak sensor	√	
Camera		
Touch Screen		
Microphone		
Speakers	√	

3. **Select the services that are installed in the house (select all that apply):**

Elderly System Interaction (voice messages)	√	Comments:
Short Messages Service (SMS) Service	√	
Video Conference Applications		
Web / Client Interfacing system	√	

4. **Select the scenarios that are operational in the house (select all that apply):**

Main door open for a given period of time	√	Comments:
Temperature is above/below a threshold	√	
Pulse is above/below a threshold	√	
Panic/Alarm Communication Button –bracelet	√	
Fall Detection / bracelet	√	
Elderly is alone at home for a given period of time	√	
Gas leak detection alarm	√	
A device is on/off	√	

5. **Were you involved in decisions about the home care service in terms of the following (select all that apply):**

Which scenarios to be operational	√	Comments:
How you wanted them to notify	√	
The period the system was operational	√	
The daily hours the system was operational	√	

6. **How satisfied are you with the HOPE system(select only one):**

I am extremely satisfied	√	Comments:
I am quite satisfied		
I am neither satisfied nor dissatisfied		
I am quite dissatisfied		
I am extremely dissatisfied		
I don't know/ no comment		

7. **Was the HOPE Alarm Service efficient when needed (select only one)::**

It always was efficient when needed	√	Comments:
It sometimes was efficient when needed		
It never was efficient when needed		
I don't know/ no comment		

8. **To what extent has the service you received improved the following:**

	Strongly Agree	Agree	Not sure	Disagree
The quality of life	√			
Your own health and well-being		√		
Relationship with your family & you			√	
Feeling safe & secure	√			

9. **Does the HOPE system improve the relationships with the elderly, family and caregiver? (select only one)::**

Always		Comments:
Usually	√	
Some times		
Never		
I don't know / no comment		

10. **In your opinion, which of the following statements best fits the support you receive (select only one):**

HOPE system always manages to support me fully when needed	√	Comments:
HOPE system usually manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
HOPE system sometimes manages to support me fully when needed		
I don't know / no comment		

11. **To what extend you agree with the following statements:**

	Strongly Agree	Agree	Not sure	Disag ree
The HOPE system makes me feel safer	√			
The HOPE system makes me feel more independent	√			
The HOPE system may reduce the caregiver-related costs		√		

12. **Does the elderly receive any practical help from friends, neighbors or family members (select one only)?**

Yes, from someone living in my household	
Yes, from someone living in another household	√
No	

13. **How long HOPE System was operational (select one only)?**

Less than 3 months	
3 months to 6 months	√
More than 6 months	
I don't know / no comment	

14. **Please comment for any changes needed in the current HOPE System functionality**

Comments:

15. **Please comment for any enhancements in HOPE System functionality in the future versions**

Comments:

16. **Are you male or female:**

Male	√
Female	

17. **How old are you:**

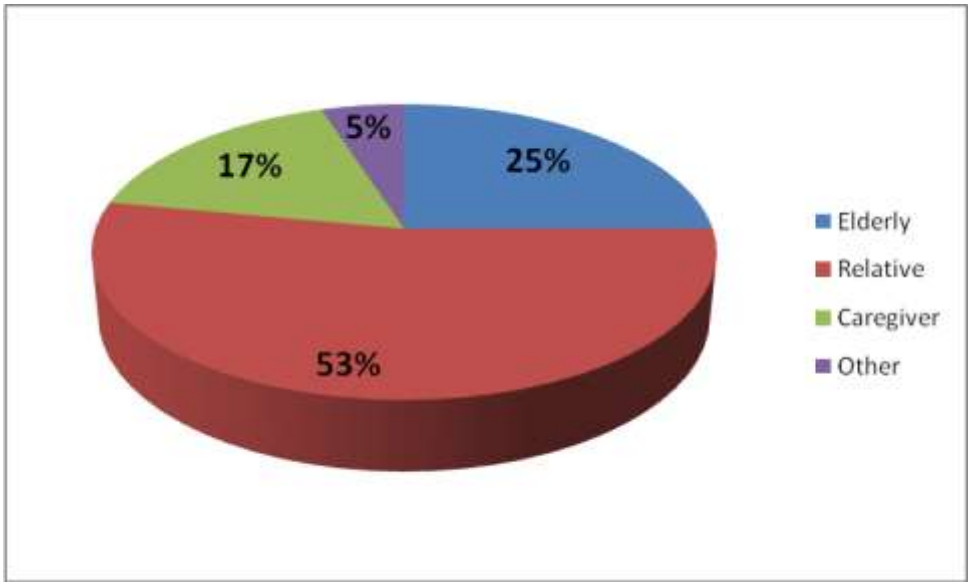
Under 60	√
60-74	
75-84	
85+	

Thank you for taking the time to helps us improve HOPE System

Statistical Evaluation of the Questionnaires

Italy

1 – Please indicate your status:



2 - Select the services that are installed in the house

All caregivers answered the same options:

- PC/Laptop & wireless sensor controller
- Open/Closed Door sensor
- Temperature sensor
- Movement/presence sensor
- Speakers

3 - Select the services that are installed in the house (select all that apply):

All caregivers answered the same options:

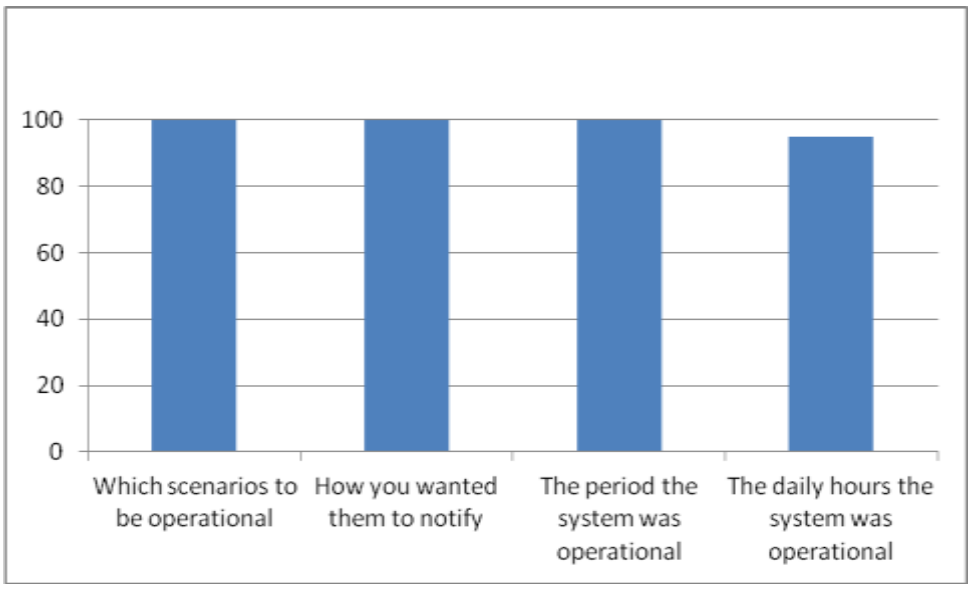
- Elderly System Interaction (voice messages)
- Short Messages Service (SMS) Service

4 - Select the scenarios that are operational in the house (select all that apply):

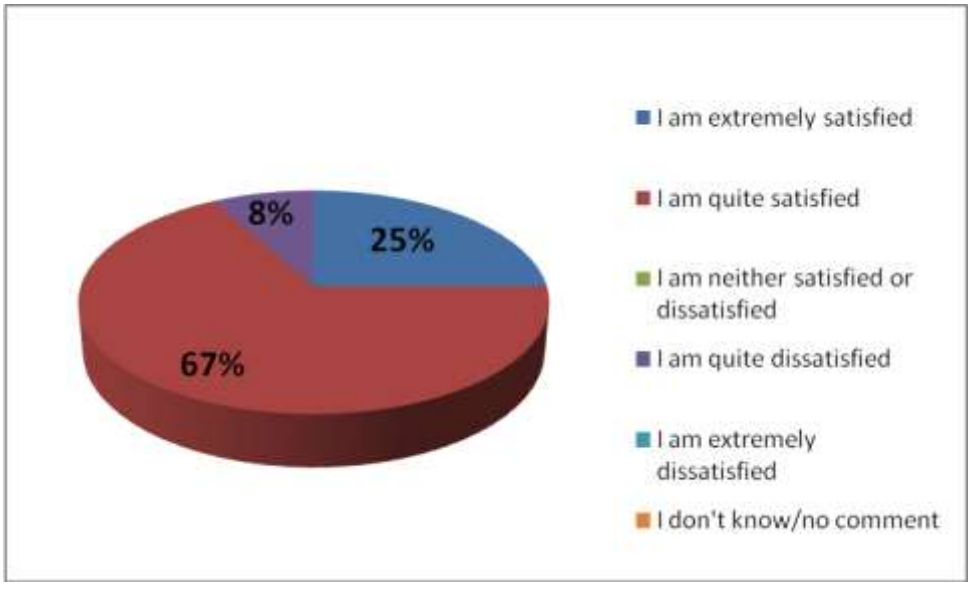
All caregivers answered the same options:

- Main door open for a given period of time
- Temperature is above/below a threshold

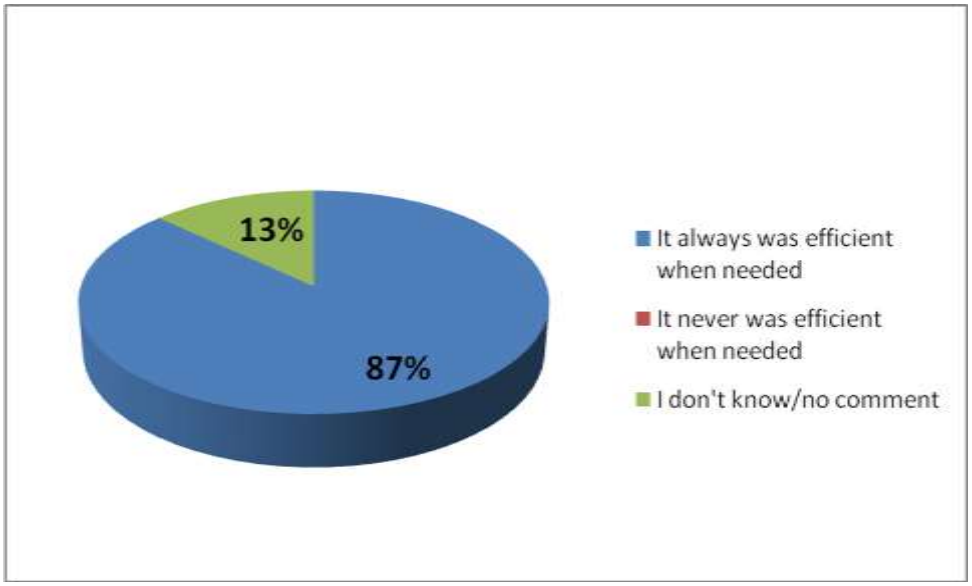
5 – Were you involved in decisions about the home care service:



6 – How satisfied are you with the HOPE system:

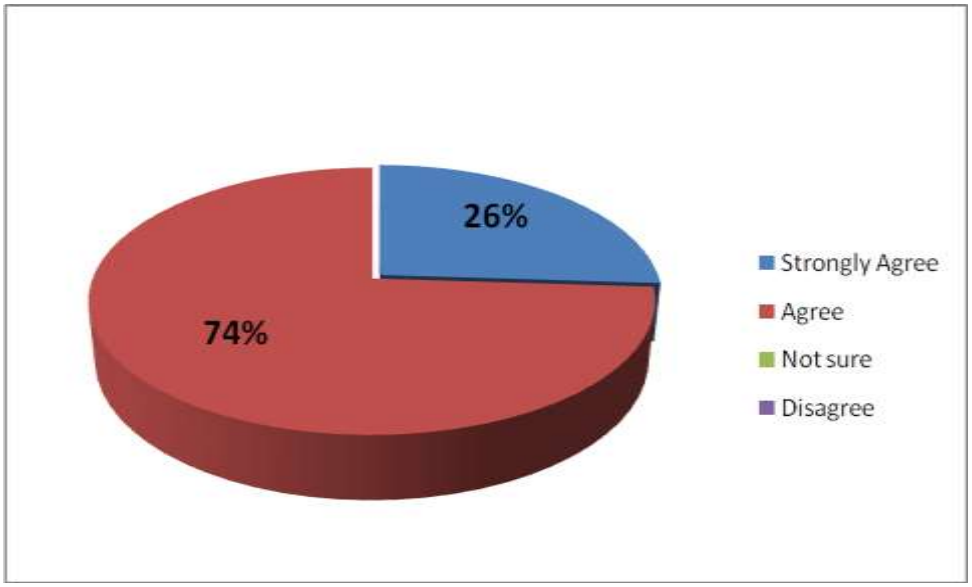


7 – Was the HOPE Alarm Service efficient when needed:

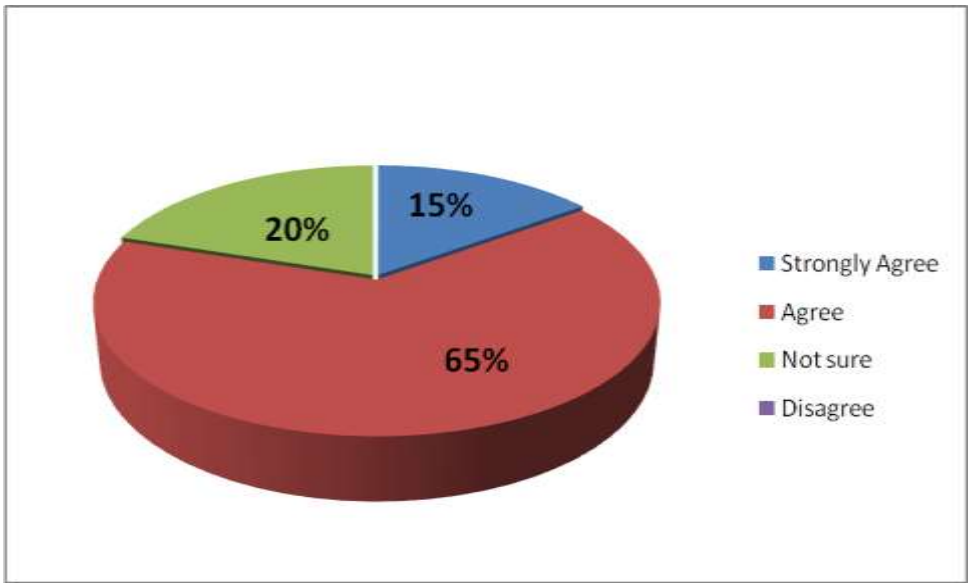


8 – To what extent has the service you received improved the following:

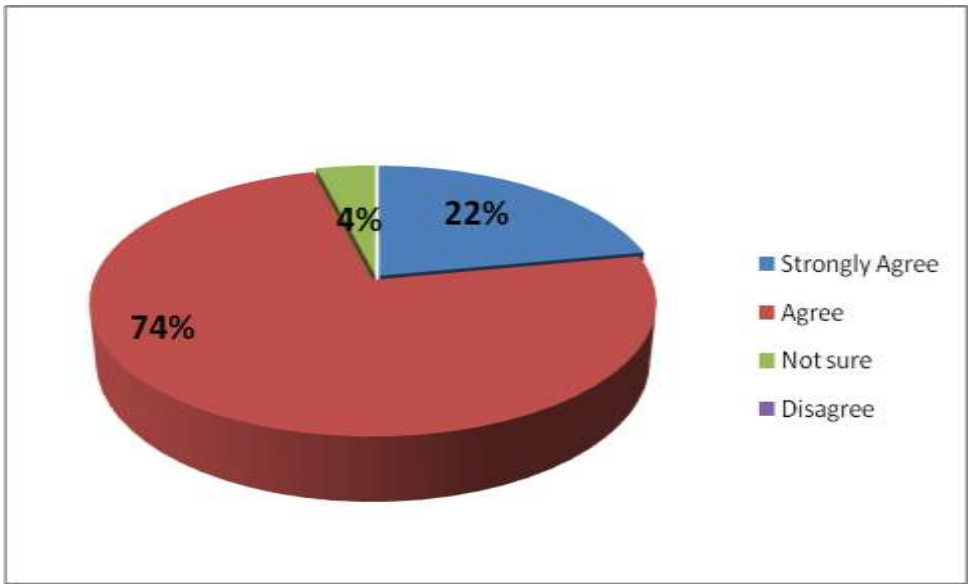
The quality of life



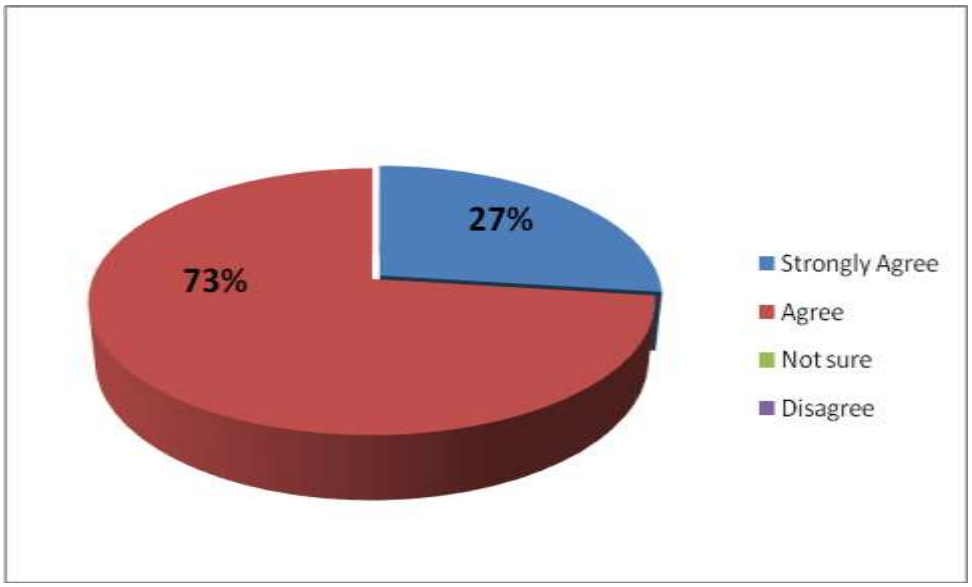
Relationship with your family and you



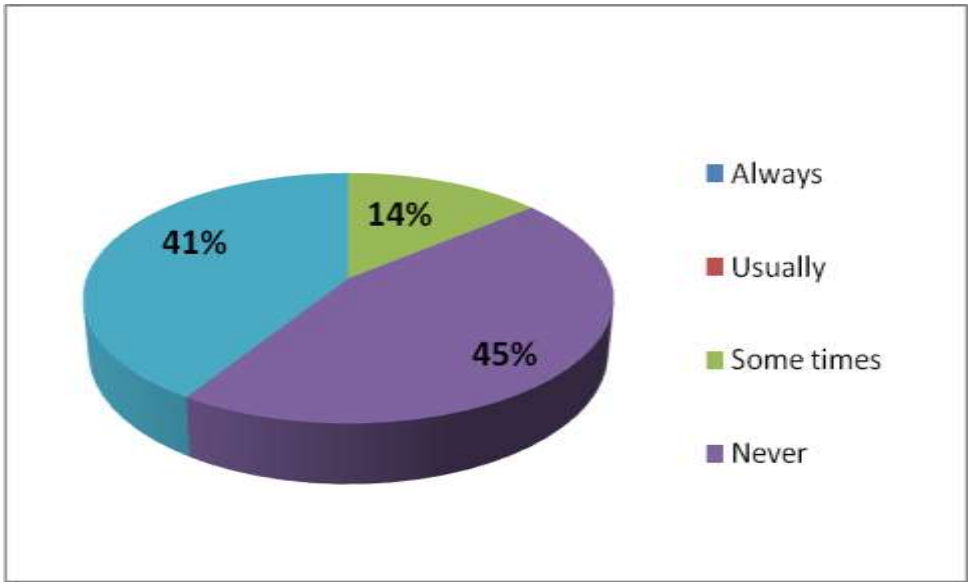
Your own health and well-being



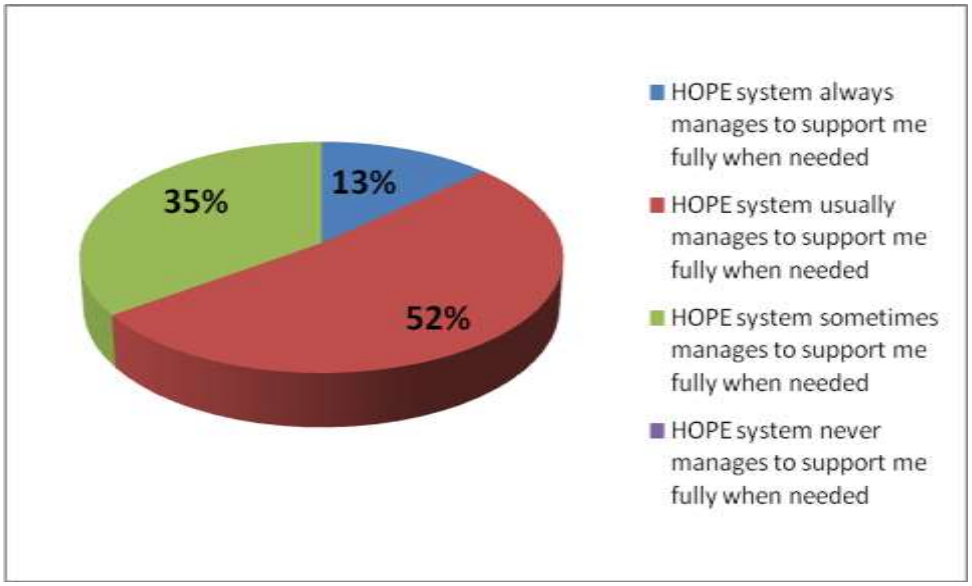
Feeling safe & secure



9 – Does the HOPE system improve the relationships with the elderly, family and caregiver?

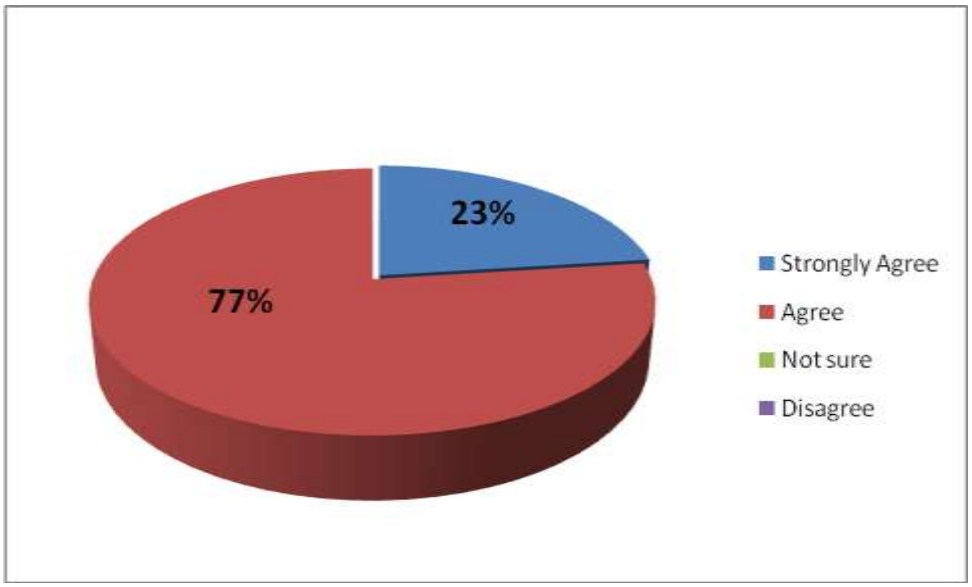


10 – In your opinion, witch of the following statements best fits the support you receive:

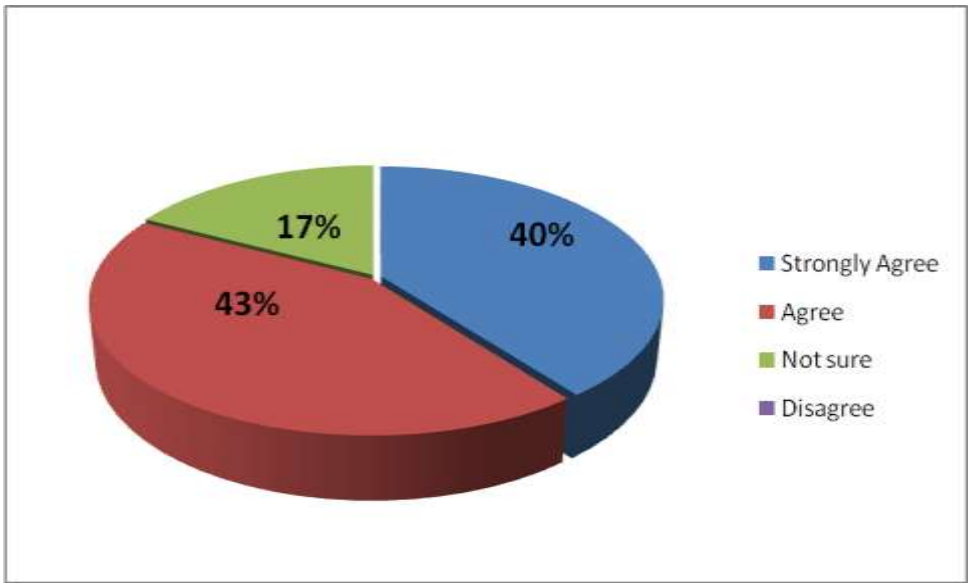


11 - To what extend you agree with the following statements:

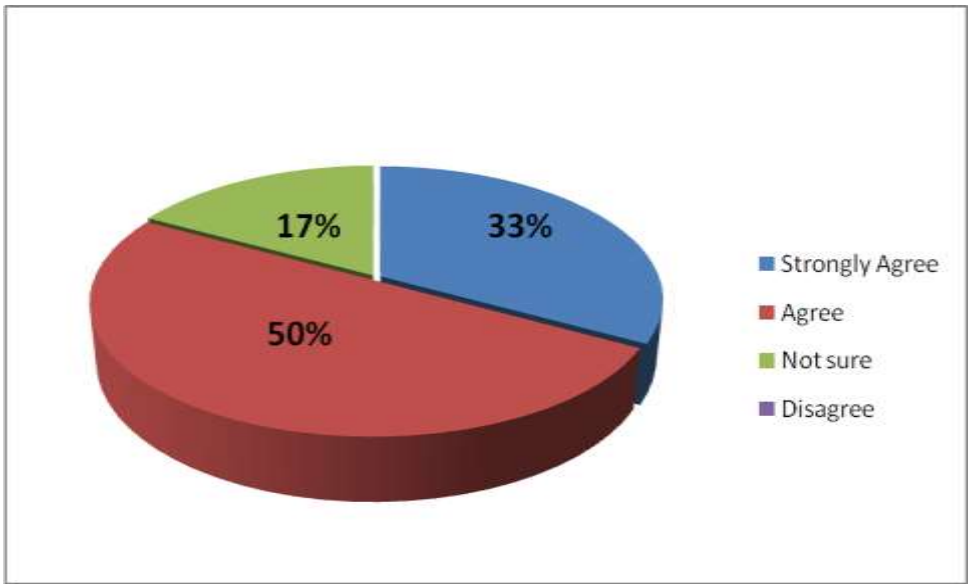
The HOPE system makes me feel safer



The HOPE system may reduce the caregiver-related costs



The HOPE system makes me feel more independent



12 - Does the elderly receive any practical help from friends, neighbours or family members?
This question was removed from the questionnaire

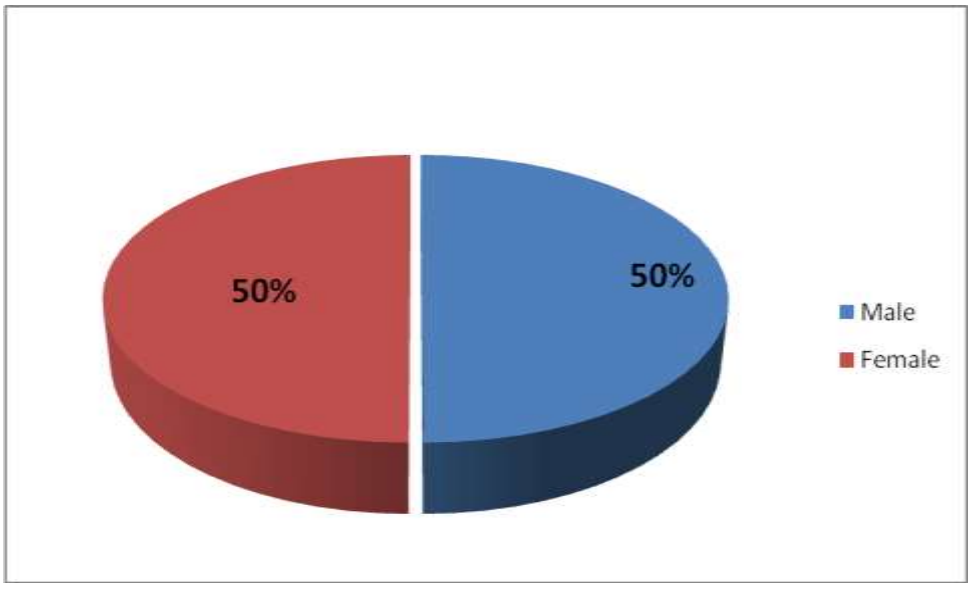
13 - How long HOPE System was operational (select one only)?
All caregivers answered:

- More than 6 months

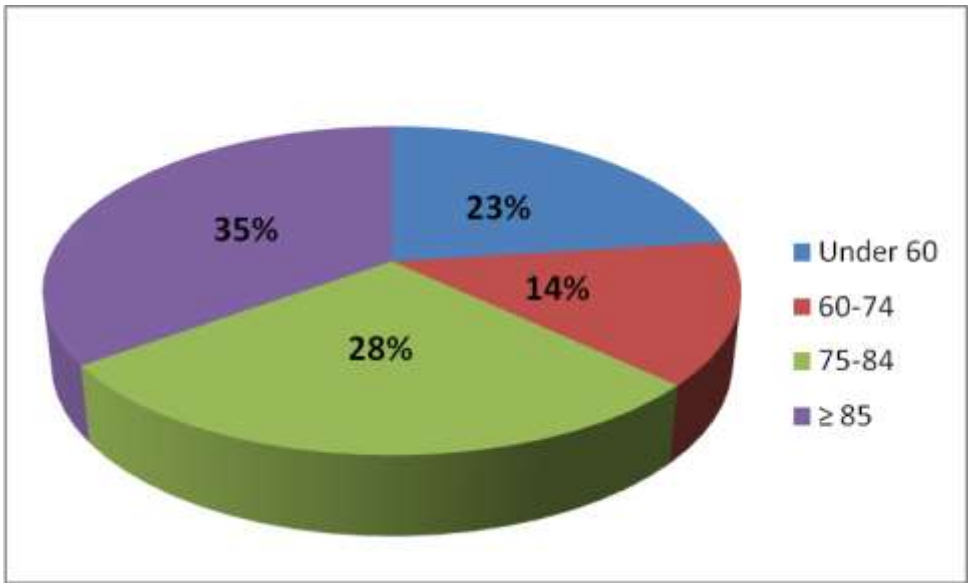
14 - Please comment for any changes needed in the current HOPE System functionality:
There wasn't any relevant comment

15 - Please comment for any enhancements in HOPE System functionality in the future versions:
There wasn't any relevant comment

16 – Are you male or female:



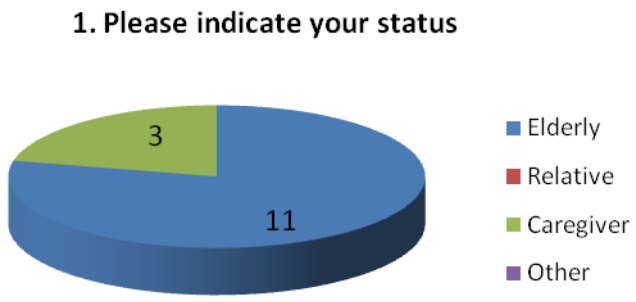
17 – How old are you:



Spain

The questionnaire was completed by some residents and caregivers at the end of the pilot, they was answered by eleven patients and three caregivers. Because the pilot was developed in a residence some questions were removed from the questionnaire. The question 12th was removed from all questionnaire and the questions: 2nd, 3rd, 4th, 5th for the questionnaire of elderly.

Below are the results of the questionnaire:



2 Select the services that are installed in the house
All caregivers answered the same options:

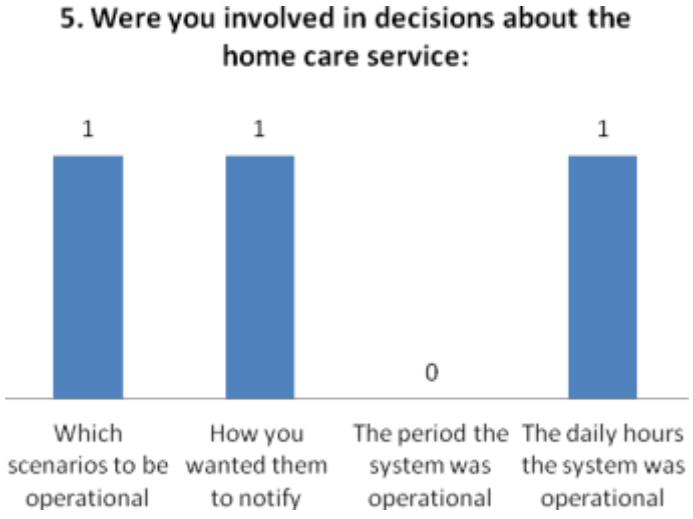
- PC/Laptop & wireless sensor controller
- Open/Closed Door sensor
- Temperature sensor
- Movement/presence sensor
- Gas leak sensor
- Speakers

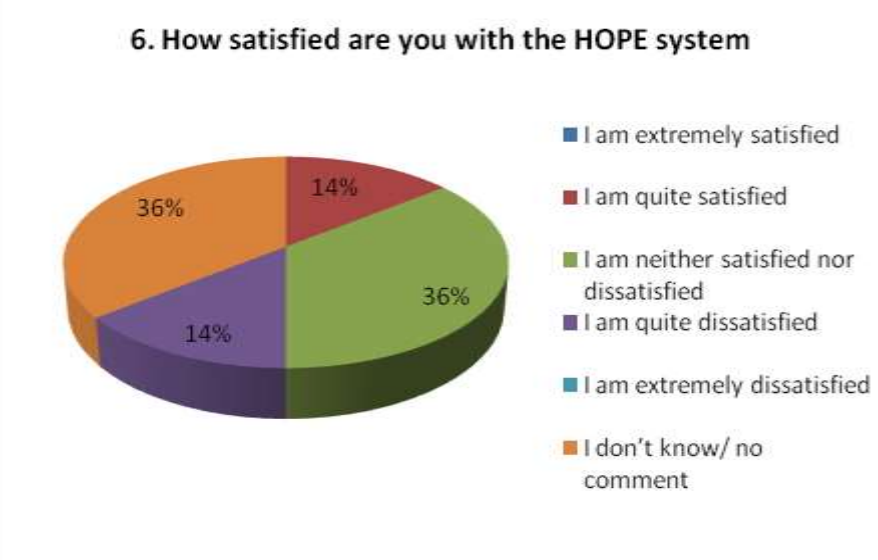
3 Select the services that are installed in the house (select all that apply):
All caregivers answered the same options:

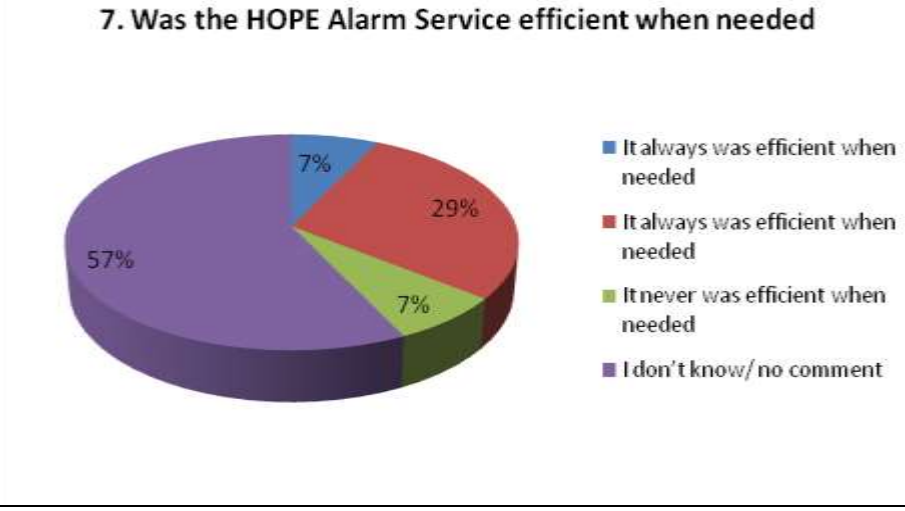
- Elderly System Interaction (voice messages)
- Short Messages Service (SMS) Service

4 Select the scenarios that are operational in the house (select all that apply)
All caregivers answered the same options:

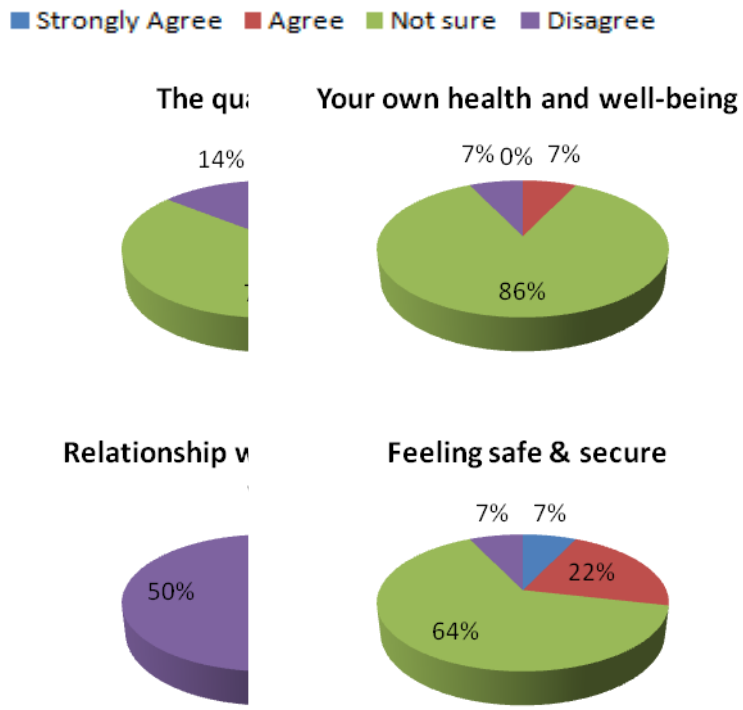
- Main door open for a given period of time
- Temperature is above/below a threshold
- Gas leak detection alarm


5. Were you involved in decisions about the home care service:
1
1
0
1
Which scenarios to be operational
How you wanted them to notify
The period the system was operational
The daily hours the system was operational

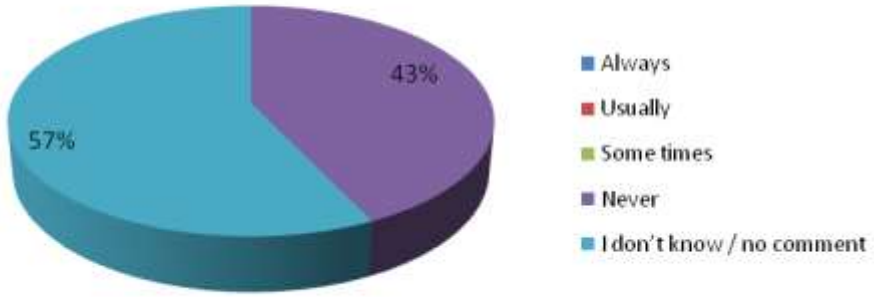

6. How satisfied are you with the HOPE system
14%
36%
36%
14%
I am extremely satisfied
I am quite satisfied
I am neither satisfied nor dissatisfied
I am quite dissatisfied
I am extremely dissatisfied
I don't know/ no comment

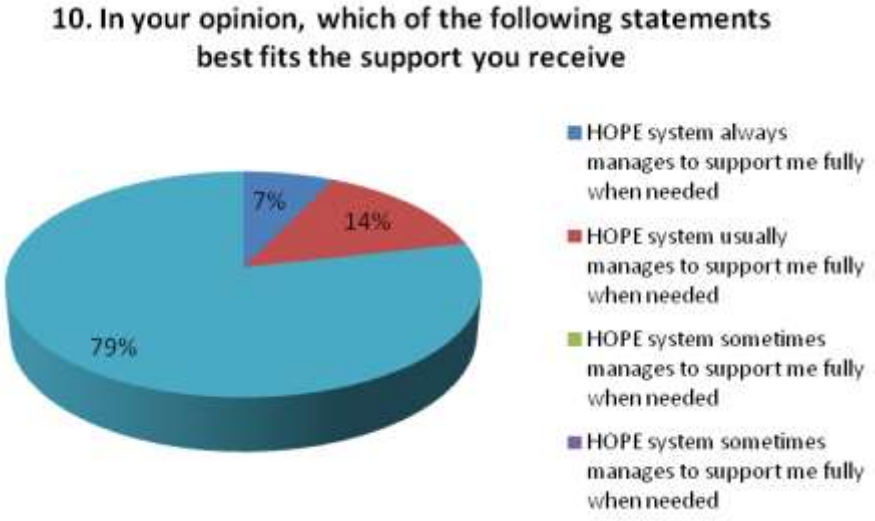

7. Was the HOPE Alarm Service efficient when needed
7%
29%
57%
7%
It always was efficient when needed
It always was efficient when needed
It never was efficient when needed
I don't know/ no comment

8. To what extent has the service you received improved the following:

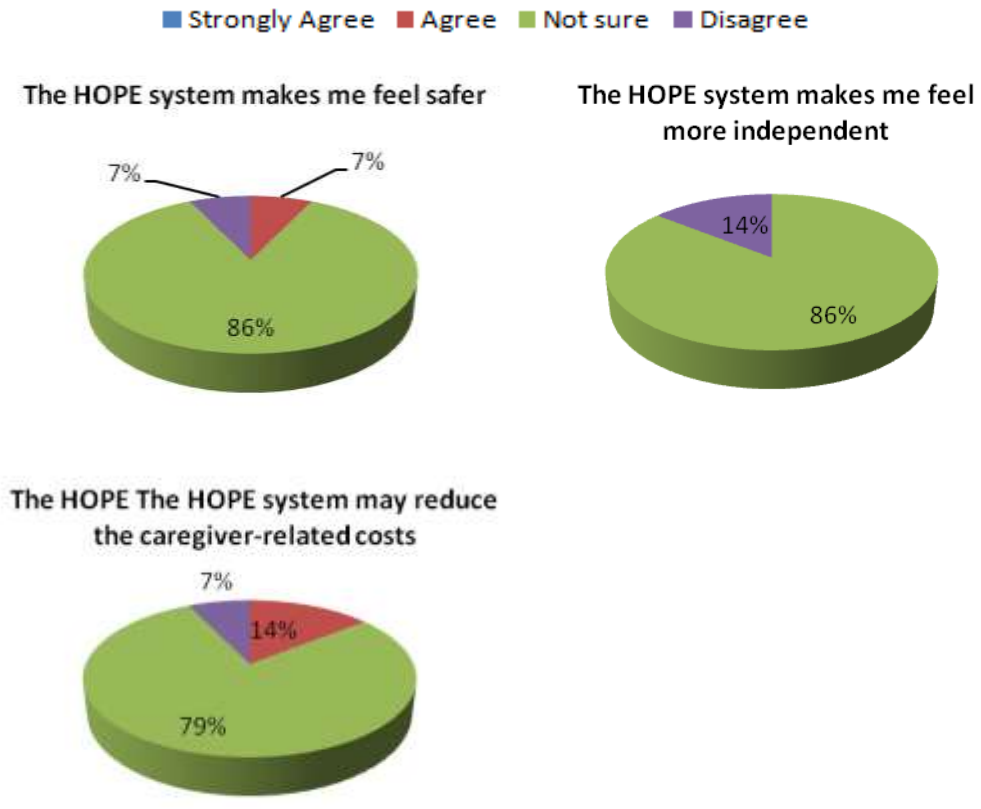


9. Does the HOPE system improve the relationships with the elderly, family and caregiver?





11. To what extend you agree with the following statements:



12 Does the elderly receive any practical help from friends, neighbors or family members?

This question was removed from the questionnaire

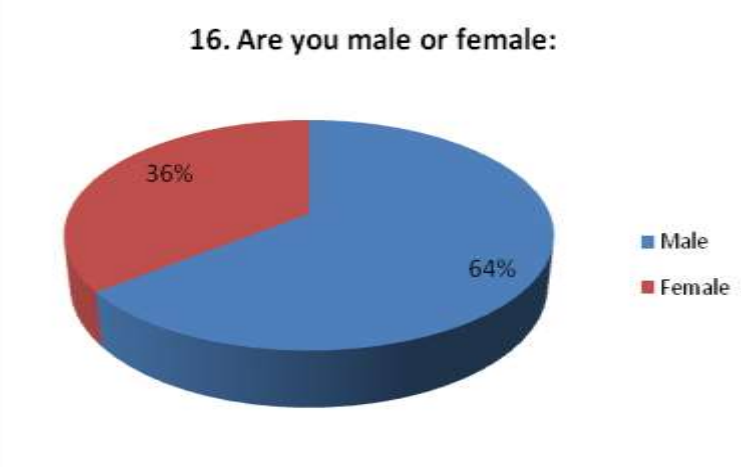
13 How long HOPE System was operational (select one only)?

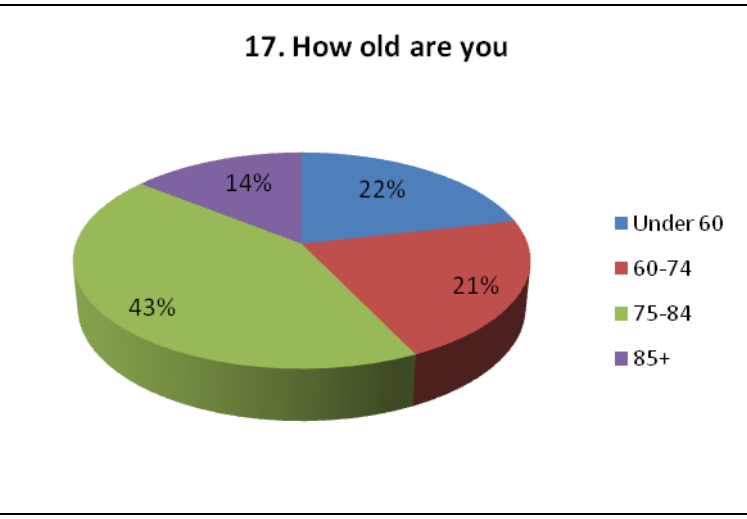
All caregivers answered

- More than 6 months

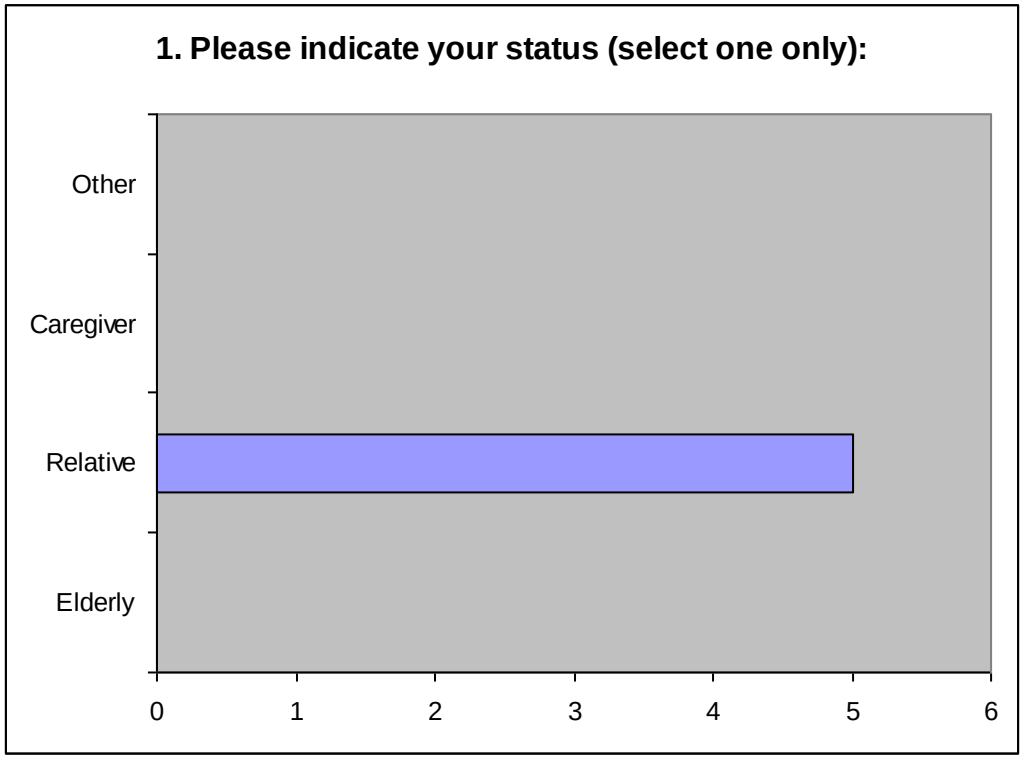
14 Please comment for any changes needed in the current HOPE System functionality
There wasn't any relevant comment

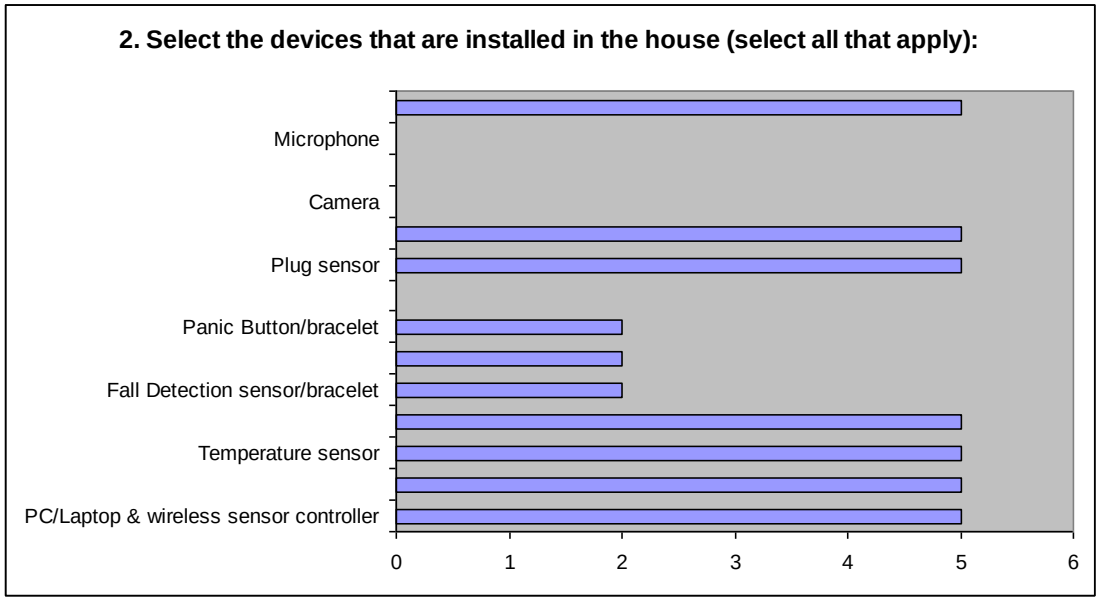
15 Please comment for any enhancements in HOPE System functionality in the future versions
Two of the caregivers commented that some voice messages sometimes were not heard and suggested adding some type of visual notification as a light or similar.

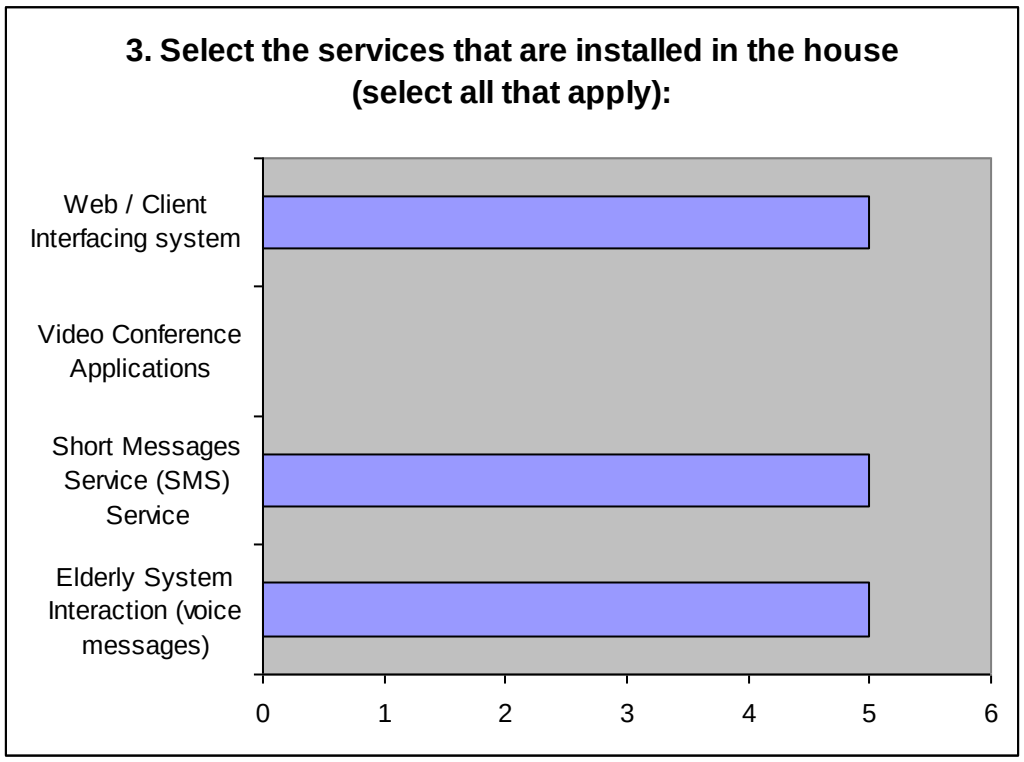


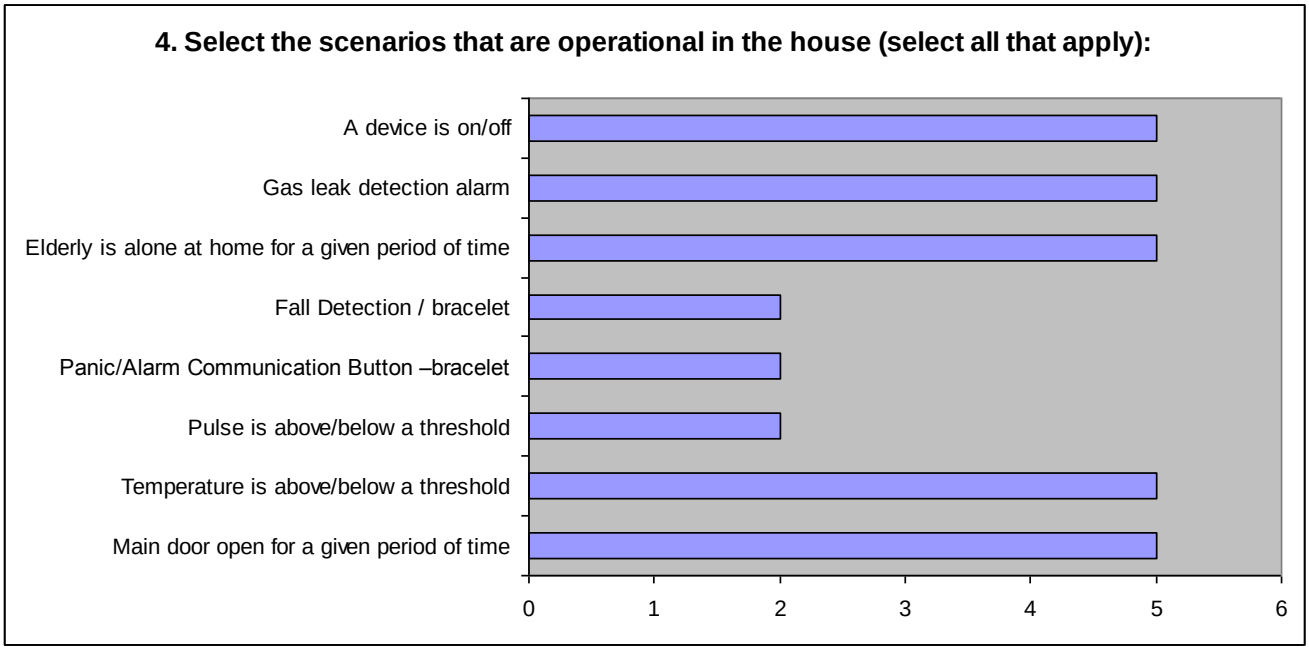


Greece

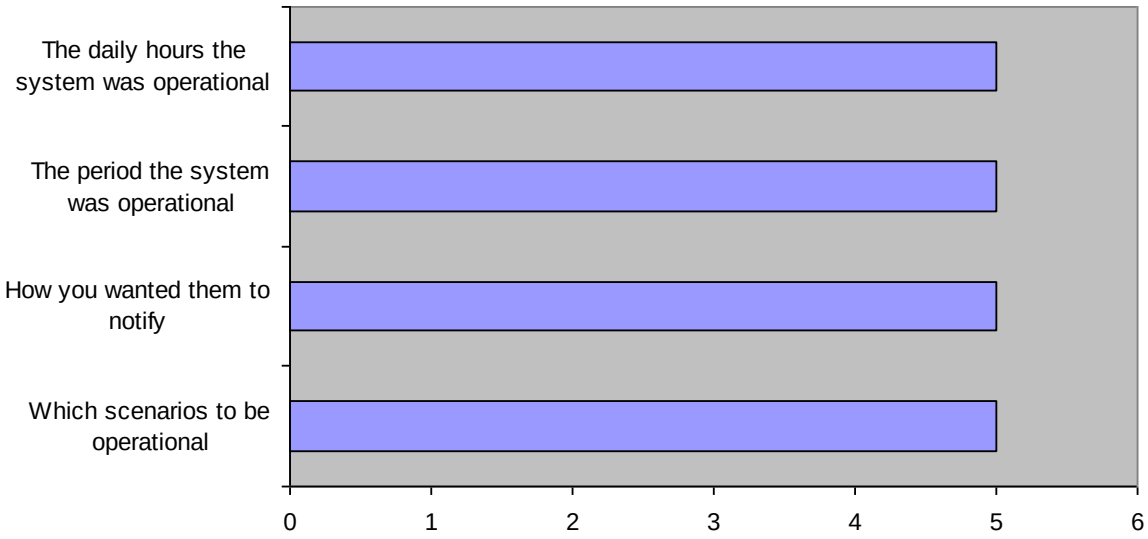

1. Please indicate your status (select one only):
Other
Caregiver
Relative
Elderly
0
1
2
3
4
5
6


2. Select the devices that are installed in the house (select all that apply):
Microphone
Camera
Plug sensor
Panic Button/bracelet
Fall Detection sensor/bracelet
Temperature sensor
PC/Laptop & wireless sensor controller
0
1
2
3
4
5
6

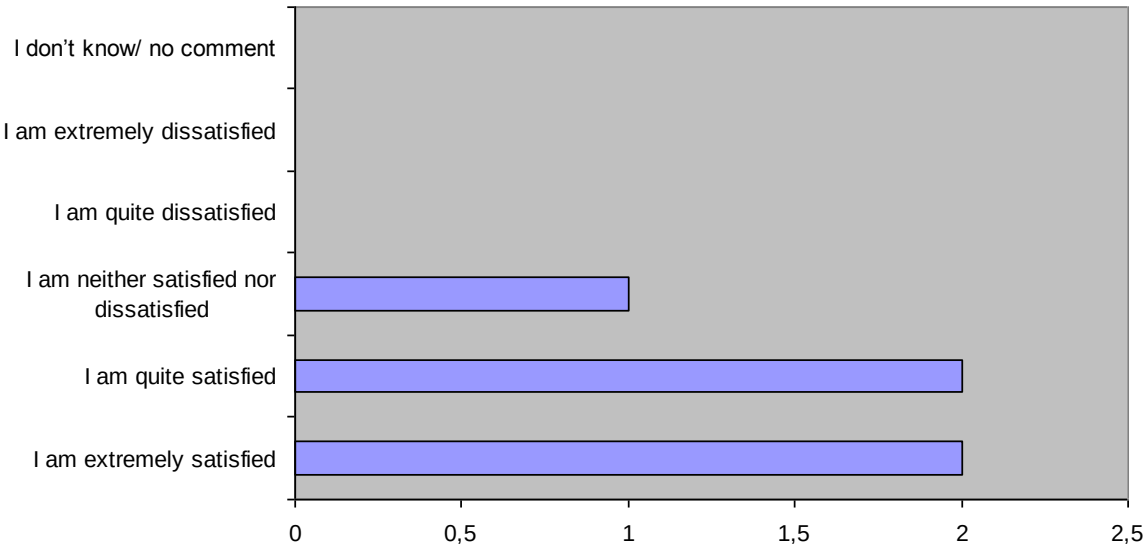

3. Select the services that are installed in the house (select all that apply):
Web / Client Interfacing system
Video Conference Applications
Short Messages Service (SMS) Service
Elderly System Interaction (voice messages)
0
1
2
3
4
5
6

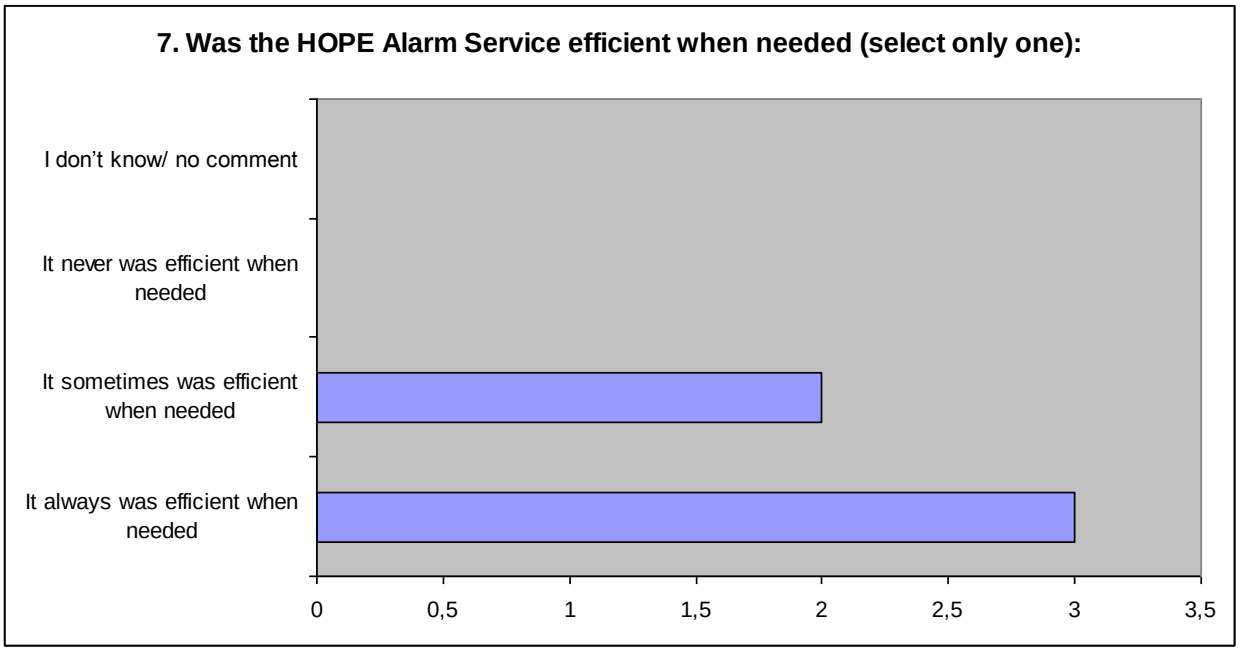

4. Select the scenarios that are operational in the house (select all that apply):
A device is on/off
Gas leak detection alarm
Elderly is alone at home for a given period of time
Fall Detection / bracelet
Panic/Alarm Communication Button –bracelet
Pulse is above/below a threshold
Temperature is above/below a threshold
Main door open for a given period of time
0
1
2
3
4
5
6

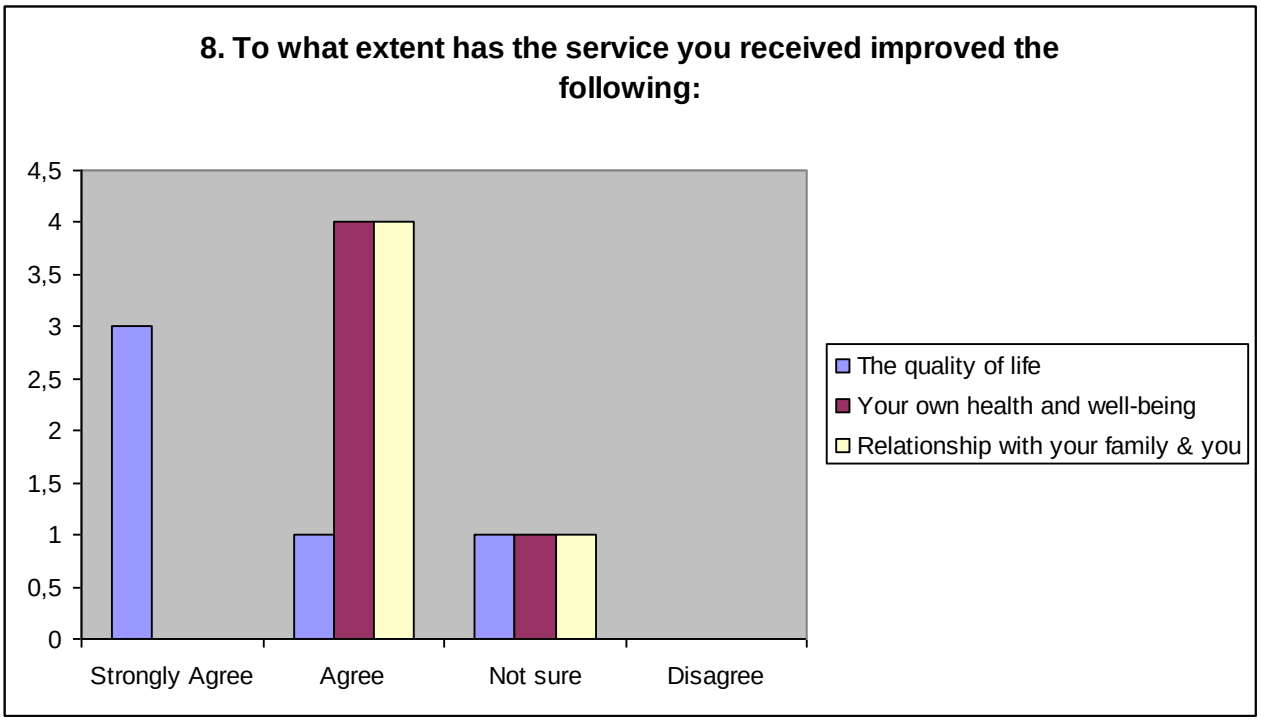
5. Were you involved in decisions about the home care service in terms of the following (select all that apply):



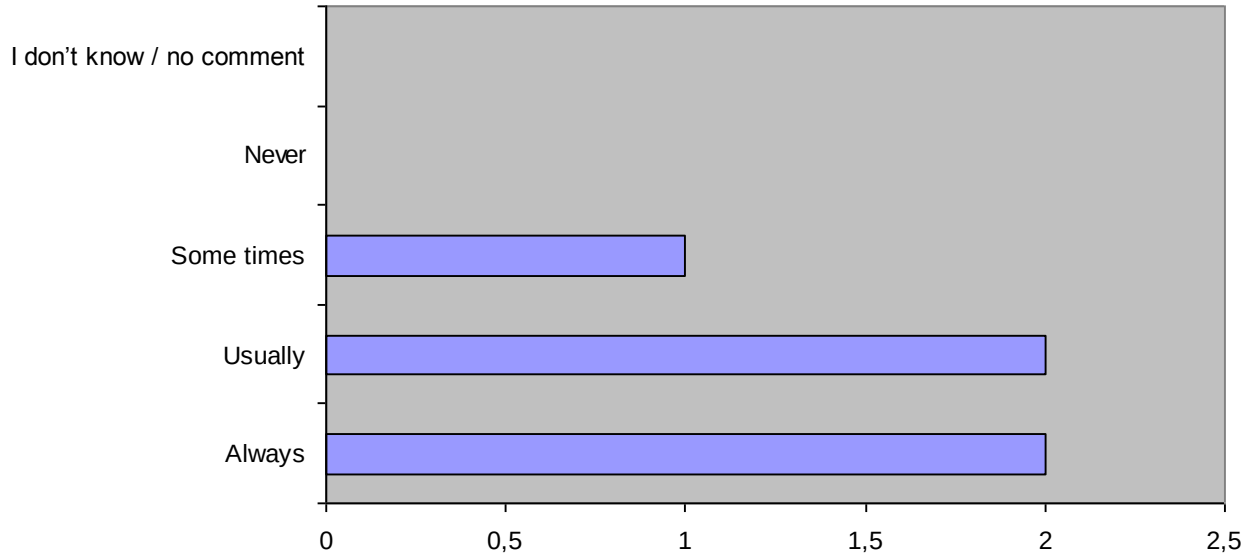
6. How satisfied are you with the HOPE system(select only one):



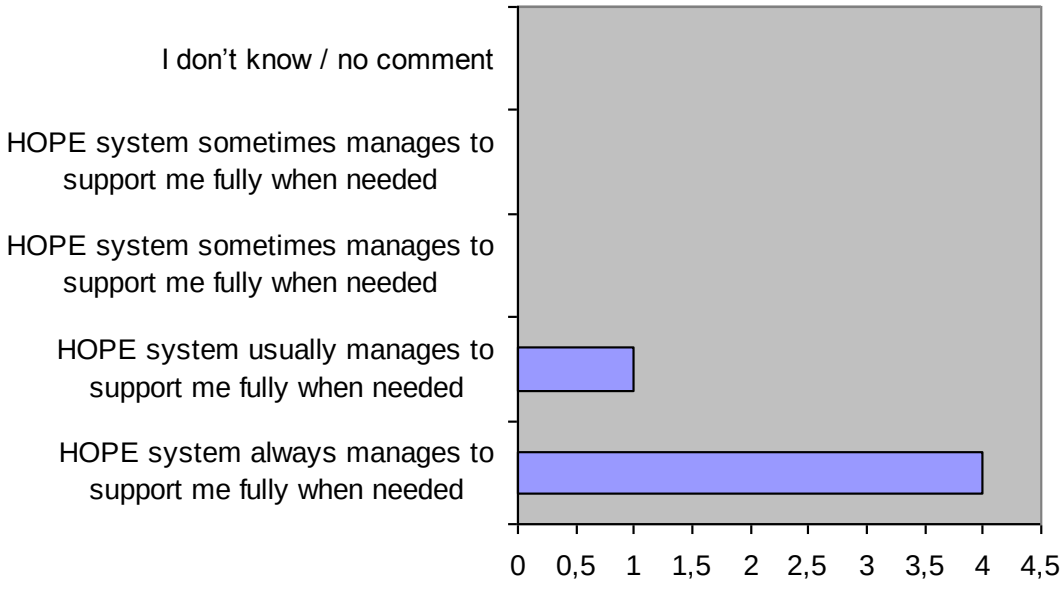

7. Was the HOPE Alarm Service efficient when needed (select only one):
I don't know/ no comment
It never was efficient when needed
It sometimes was efficient when needed
It always was efficient when needed
0
0,5
1
1,5
2
2,5
3
3,5

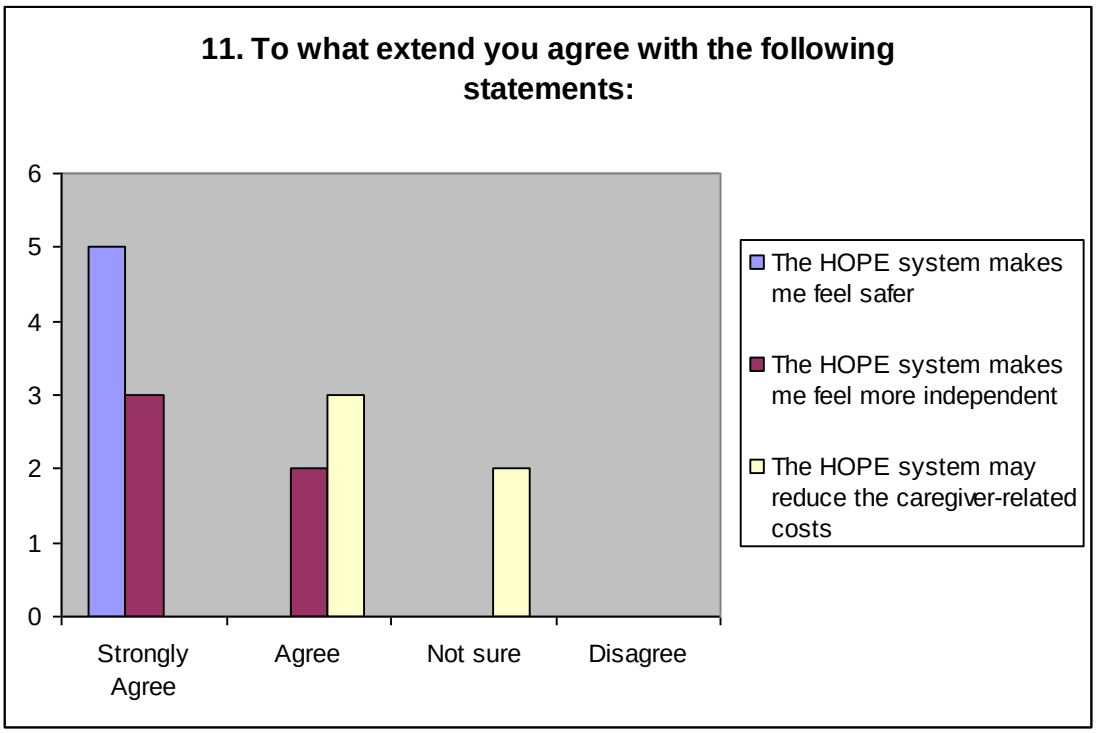

8. To what extent has the service you received improved the following:
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
Strongly Agree
Agree
Not sure
Disagree
The quality of life
Your own health and well-being
Relationship with your family & you

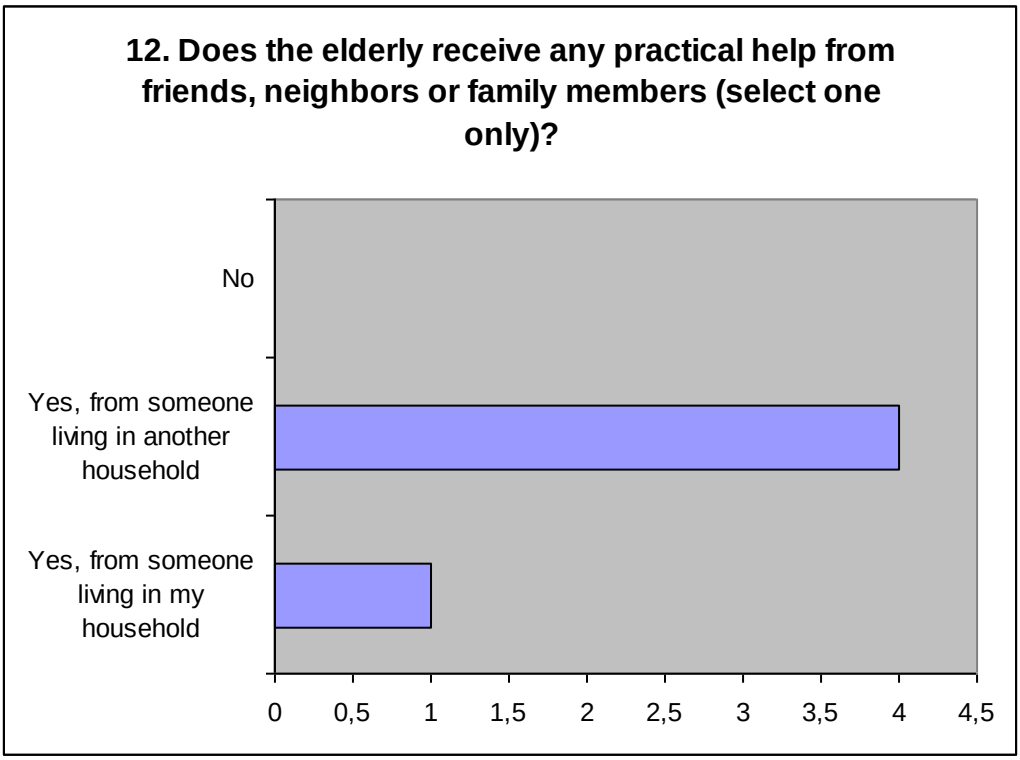
9. Does the HOPE system improve the relationships with the elderly, family and caregiver? (select only one):

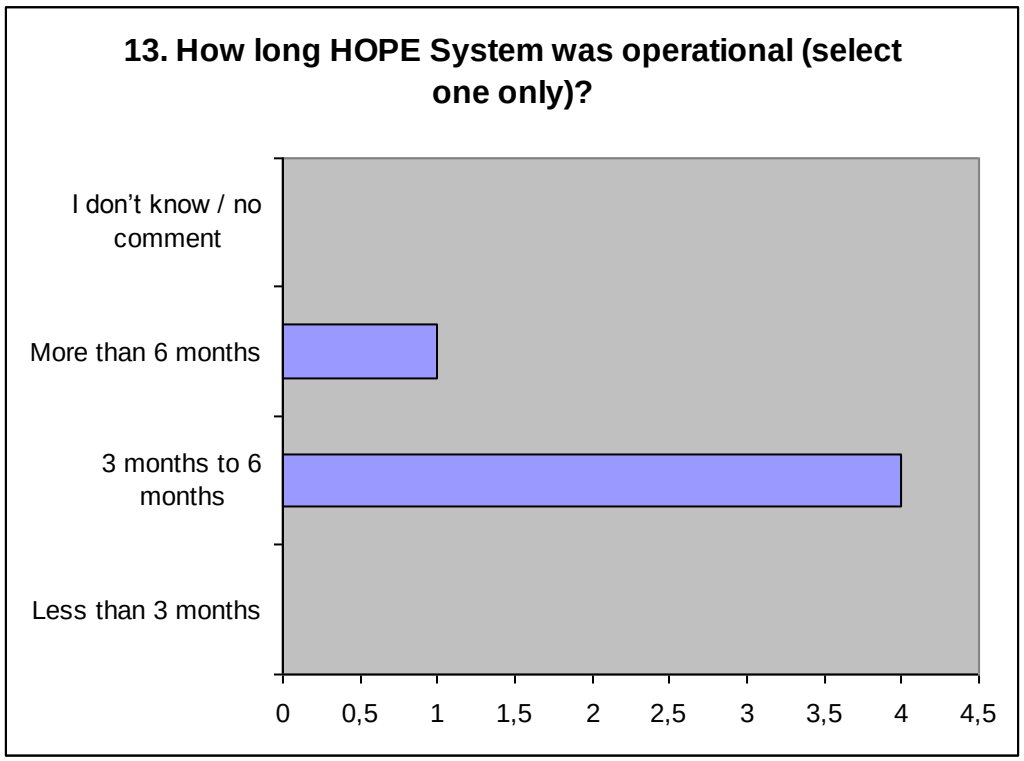


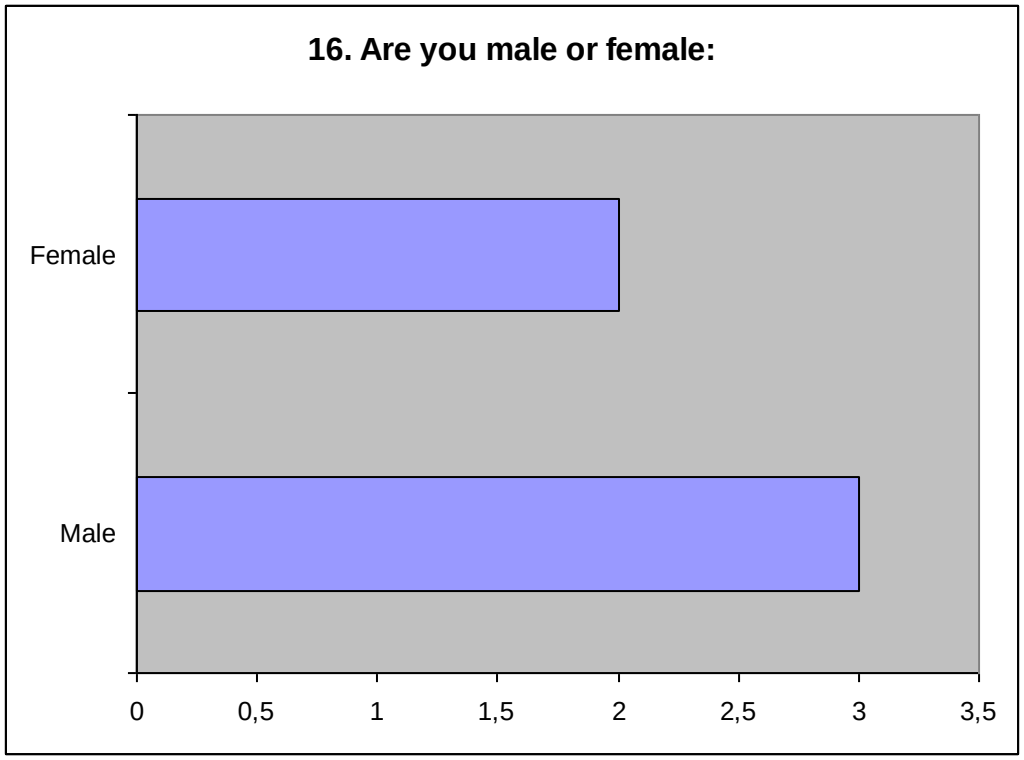
10. In your opinion, which of the following statements best fits the support you receive (select only one):

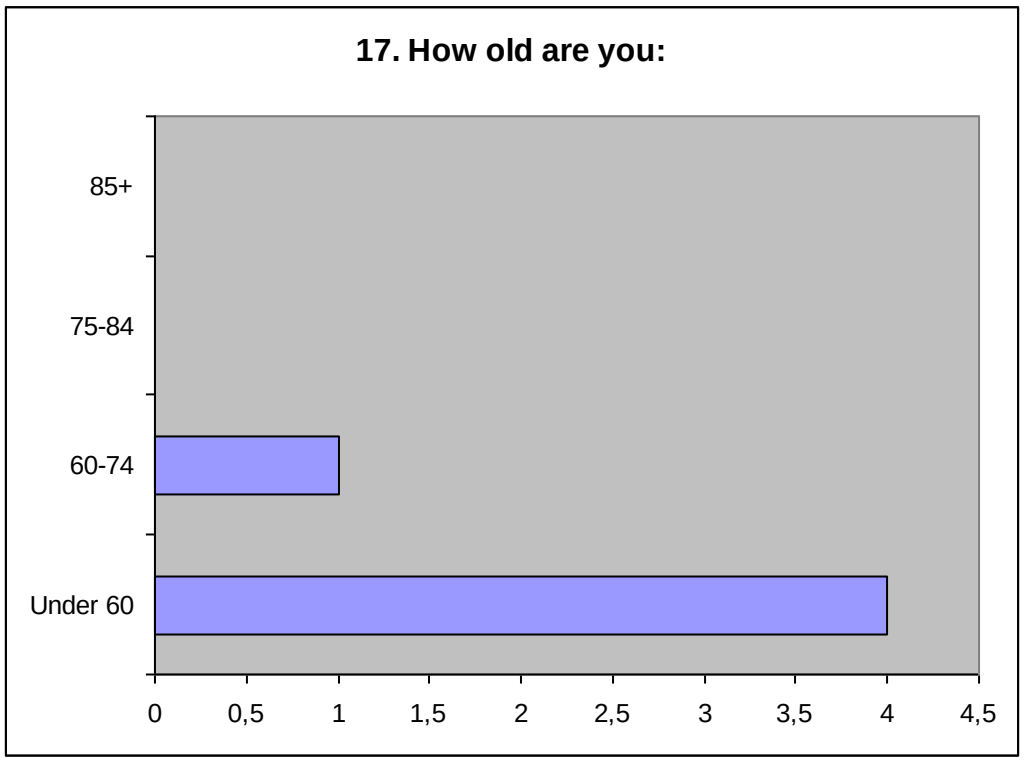



11. To what extend you agree with the following statements:
6
5
4
3
2
1
0
Strongly Agree
Agree
Not sure
Disagree
The HOPE system makes me feel safer
The HOPE system makes me feel more independent
The HOPE system may reduce the caregiver-related costs


12. Does the elderly receive any practical help from friends, neighbors or family members (select one only)?
No
Yes, from someone living in another household
Yes, from someone living in my household
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5


13. How long HOPE System was operational (select one only)?
I don't know / no comment
More than 6 months
3 months to 6 months
Less than 3 months
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5


16. Are you male or female:
Female
Male
0
0,5
1
1,5
2
2,5
3
3,5


17. How old are you:
85+
75-84
60-74
Under 60
0
0,5
1
1,5
2
2,5
3
3,5
4
4,5

Conclusions

This document resumes the Assessment and Evaluation results in the different countries by the HOPE project partners. First, a description of choices done for the pilot's installation is detailed together with the number of installations done and their geographical position. Then, a detailed analysis of systems, sensors and services for each pilot is described. Besides, the Italian Hospital partner proposed a detailed description of evaluation procedures and results obtained. Finally, each partner described the lessons learned during the project and their suggestions for next improvements.

Latest pages are for a highlight of the end-user questionnaires proposed to the patient's relatives and relevant statistics after questionnaires analysis.

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