



Experiences of Older Adults and Long-Term Care Institutions Regarding Technical Solutions: Evaluation Results from Austria

ORIGINAL RESEARCH

2018, 1(2), 89-98
doi: 10.5505/jaltc.2018.25733

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Abstract

Ambient Assisted Living solutions (AAL solutions) are designed to make an important contribution to an active, independent, safe and socially integrated life in old age. In the scope of the West-AAL project, ICT-based (Information and Communication Technology) living and housing using AAL solutions was tested actively in more than 60 households of independent older adults in West Austria over a longer period. An evaluation strategy was developed that comprises both qualitative and quantitative aspects. Within this strategy, selected aspects of quality of life were used as indicators. The presentation of results is oriented towards the fields of application of tAALxonomy. The following fields were used in this project: Leisure and Culture, Information and Communication, Health and Care, Housing and Buildings and Safety and Protection. During the test period, habituation effects are to be expected, which are reflected in the results. The project is characterized by the test subjects' individual choice of solutions. No general assertions can be made based on these, but due to the methodical consolidation using tAALxonomy, a larger random sample per field of application can be achieved.

Keywords: Ambient assisted living, technical solutions, evaluation, gerontechnology, gerontology.

Key Practitioners Message

- Older adults are generally open to use new technical solutions.
- However, it requires the accompaniment and guidance of relatives or professional caregivers for permanent use.
- The willingness of older adults to use technical solutions is decreasing if the devices do not work properly.
- The willingness to use technical solutions is increasing when the personal benefit is recognized.

Introduction

Ambient Assisted Living solutions (AAL solutions) aim to be an important contribution to an active, independent, safe and socially integrated life in old age. In the scope of the West-AAL project, ICT-based living and housing using AAL solutions was tested actively in more than 60 households of

independent older adults in West Austria over a longer period. An AAL solution means that the test subjects are given a technical device to use free of charge for the duration of the test.

The consortium of the West-AAL test region comprised four research institutes, two ICT service providers/system integrators and six mobile and social services providers (test facilities). The test

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Received: 24 January 2018 | *Accepted:* 5 August 2018 | *Published Online:* 15 August 2018



settings here ranged from mobile care and older adult's apartments to assisted living. The total duration of the project was set down as 3.5 years (January 2014 - May 2017) and it was supported by the Austrian Ministry of Transport, Innovation, and Technology (BMVIT) in the scope of the *benefit* funding programme, with the thematic focus on the test region *Smart Homes - Smart Services*. The focus here is on benefit-oriented innovative smart home and smart service solutions, which are based on the latest information technologies, and are used in assisted and sheltered living, as well as in the general living environment in the interests of the occupants and the operators.

In the test region, technical and service-oriented solutions from research projects together with solutions already available on the market were tested regarding their widespread and combined use. Priority was given here not only to technical integration, but also to the application and embedding of AAL solutions in existing structures, together with creating new services and verifying the forecasted benefits along the whole value chain. This also aimed to create socio-economically acceptable future application scenarios.

The aim of the project was to offer each of the older adults taking part an individually tailored solution package. To do this, first a product catalog was compiled, which was subsequently adapted to suit the wishes and requirements of the participants. This made it possible to define a specific user-oriented selection of technical solutions. This was carried out in the interests of both the test subjects and the testing facilities.

Methodology

During the project, an evaluation strategy was developed for the 10-month test period, which included both qualitative and quantitative aspects. Within this mix of methods (Mayring, 2001), selected aspects of quality of life were used as indicators.

A questionnaire that comprised two dimensions was developed to collect the quantitative data. To begin with, test subjects were asked about their emotions while using technical solutions. Then there was a comprehensive block of questions

about the effects of the solutions used on previously defined areas of life. In accordance with the project structure, these were: everyday activities and routines, freedom of movement, convenience, autonomy/independence, health, personal security, and frequency of contact with family and friends. These questions were asked separately for every solution used. The questionnaires were employed at five scheduled data collection points in time, each eight weeks apart, and were therefore called *regular questionnaires*. The data collected was evaluated using Version 22D of the SPSS statistical data evaluation programme. The analysis was carried out purely descriptively, using 5- or 7-point Likert scales.

Parallel to this, qualitative data was collected. This took place in the form of experience days (focus groups with staff and test subjects), reflective discussions (guided interviews), keeping a research diary (scientists' diary), filling out feedback forms, and making a support system available. This involved employees of the partner research institute visiting the test facilities and asking the test subjects about their experiences in using the technical solutions. The answers were documented, compiled and then categorized. The participating test facilities were also given the option of conveying their experiences via questionnaires, in order to achieve a comprehensive overview of the progress of the test period. All support inquiries were collected via a central tool and used in the qualitative analysis accordingly. All qualitative data were evaluated using an in-house evaluation matrix based on Microsoft Excel 2016.

The results presented below represent a selection of the evaluated data.

Annotated Presentation of the Results

In the following, the results of the data collections during the test period are presented. The presentation of the results is oriented towards the fields of application of tAALxonomy (2015). This is an AAL specific taxonomy, which groups AAL solutions (products and services) to fields of application; it was developed by the University of Innsbruck in 2015. The following fields of application were used for this project: Leisure and Culture, Information and Communication, Health and Care,

Housing and Buildings and Safety and Protection. These fields have to be consolidated, as only a small number were tested per solution due to the tailor-made solution packages.

To begin with, the quantitative data for each of these fields of application is presented graphically. Here the development of the influence on the selected quality of life indicators when using AAL solutions during a test period of 10 months is analyzed and presented. In addition to this, the qualitative data is processed using the same structure.

The graphic color scheme represents the following: regular questionnaires at collection date 1

questionnaires, the number of completed items is less than the total number of the participants. The number (n) of questionnaires per question block is listed in the appendix.

Emotions

The test subjects were asked here which of the emotions listed below they experienced while using the solutions. A semantic differential was selected for the survey, in which opposite emotions were entered as pairs. It can be concluded that throughout all collection dates the test subjects' emotions were rated altogether positively. It becomes clear that fluctuation - except for the *isolat-*

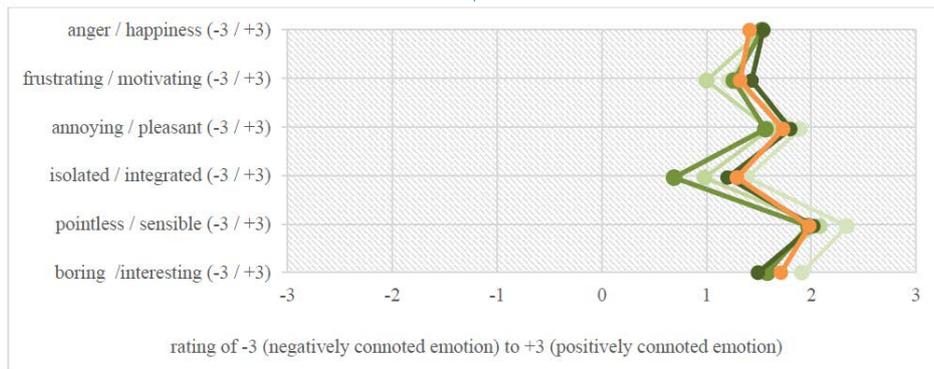


Figure 1: Emotions

(light green) increasing to regular questionnaires at collection date 4 (dark green) plus regular questionnaires at collection date 5 (orange).

The sociodemographic data of the participants were collected in an initial questionnaire. A total of 62 persons participated in this survey, who were on average 78.66 years old (mean, ± SD: 10.50, MD: 81). Of these, 45 persons (72.6%) were female and 17 persons (27.4%) were male. However, as not all participants have completed all the

ed/integrated pair of emotions - is relatively small. This means that the test subjects experienced practically consistent emotions during the whole test period.

Effects of the Solutions on the Leisure and Culture Field of Application

Here the test subjects were asked what effects the *Leisure and Culture* solutions have on pre-defined areas. In this field of application, the following

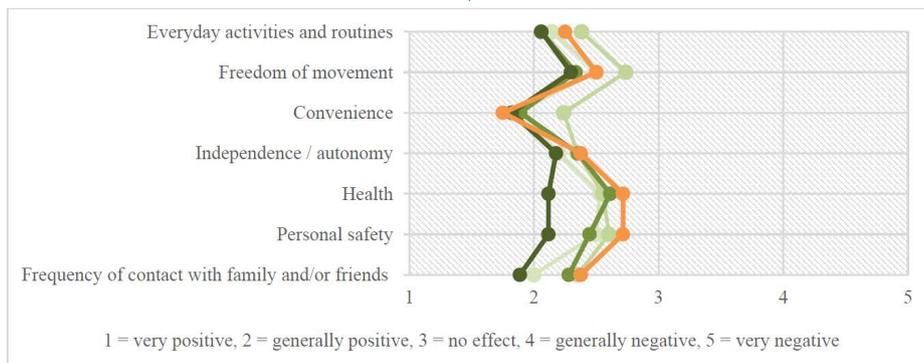


Figure 2: Effects of the solutions on the Leisure and Culture field of application

technical solutions were presented as a group: tablet solutions, which provide functions for entertainment, photo management, and exchange, and memory training.

Quantitative results

From the quantitative data, it can be established that the test subjects experienced positive effects of the solutions on all indicators of quality of life they were asked about. The positive perception of *convenience* is particularly prominent, which increased during the whole test period. In aspects of life such as *personal safety, health, and frequency of contact* there is a deterioration, which could be because the solutions were unable to influence these aspects noticeably.

Qualitative results

From the qualitative data, it can be established that the test subjects questioned are very satisfied

on pre-defined areas. In this field of application, the following technical solutions were presented as a group: tablet solutions, which offer functions for video and phone telephony, information, reminders, messages, and emails.

Quantitative results

The quantitative data shows that all indicators register a positive influence on the quality of life. In the aspects of *Independence/Autonomy* and *Comfort*, the positive perception is at its strongest at the end of the test period. The frequency of *Contact with Family and Friends* is also generally positively rated. This is probably due to the use of video and phone telephony, which also became clear in the qualitative data.

Qualitative results

The qualitative data illustrates that video telephony is used very well by the test subjects, especially

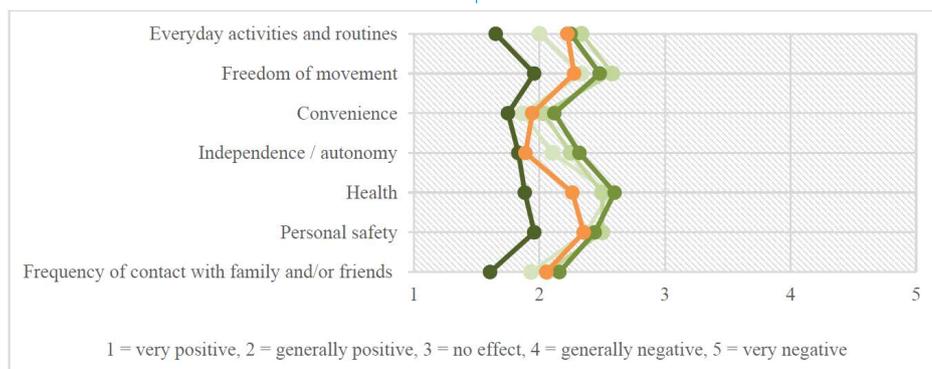


Figure 3: Effects of the solutions on the Information and Communication field of application

with the functions offered, are able to manage them well and have fun using them. However, it is viewed as a problem that apps crash and that tablets sometimes perform their task badly. Physically active people tend to use tablets less.

The test facilities concluded that using auxiliary pens to operate tablets is perceived as helpful. The configuration of the tablets is described as complex, and partly weak performance is also reported. Some of the functions offered, e.g. zoom, could not be accessed in some cases.

Effects of the Solutions on the Information and Communication Field of Application

Here the test subjects were asked what effects the *Information and Communication* solutions have

when communicating with relatives abroad. Some subjects only read their daily newspaper on their tablet. Subjects reported that it is easy to learn how to use the functions. In some cases, there were problems connecting to the internet. Some subjects find writing emails difficult, and some thought there might be a danger of spending too much time with the tablet.

The test facilities report that subjects really like using the tablets, after initial skepticism. The functions available are interesting and provide motivation to take part in the project. They also report that most of the test subjects use the functions independently. When problems arise, the tablet is restarted to solve these. It is often difficult to find free apps without advertising - which older

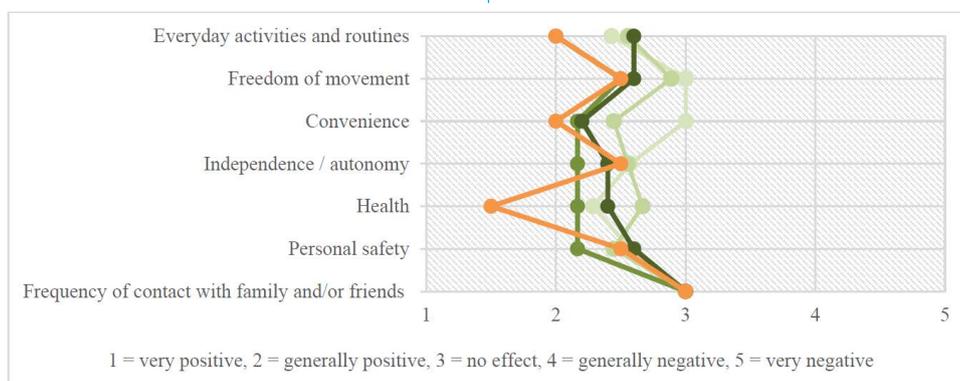


Figure 4: Effects of the solutions on the Health and Care field of application

adults find annoying and troublesome. Subjects also complain that tablets switch to standby quickly and that the test facility staff have to provide a high level of supervision.

Effects of the Solutions on the Health and Care Field of Application

Here the test subjects were asked what effects the *Health and Care* solutions have on pre-defined areas. In this field of application, the following technical solutions were presented as a group: tablet solutions, which offer functions for monitoring vital bodily data, solutions for inactivity recognition and automated notification regarding the day's progress.

Quantitative results

The quantitative data in this field of the application indicates an improvement in rating during the test period. Only the *Frequency of Contact* aspect remains unchanged, while all other aspects are given an improved rating. Towards the end of the test period, the rating of the *Health* aspect becomes more positive. This could be because the be-

nefit, which is focused on particularly in this field, is also appreciated accordingly.

Qualitative results

In the qualitative data, test subjects report using the solution on a regular weekly basis. However, weighing themselves is considered demanding, as they have to keep their balance.

The staff at the test facilities report that test subjects find using the blood pressure cuff difficult. This is mostly only used by the supervisory staff at the test facilities.

Effects of the Solutions on the Living and Buildings Field of Application

Here the test subjects were asked what effects the *Living and Building* solutions have on pre-defined areas. In this field of application, the following technical solutions were presented as a group: house automation solutions, which offer functions that control light, heating and shutters, together with automatic switch-off for electric cookers and other electrical devices, radio keys and automated notifications regarding room temperature and humidity.

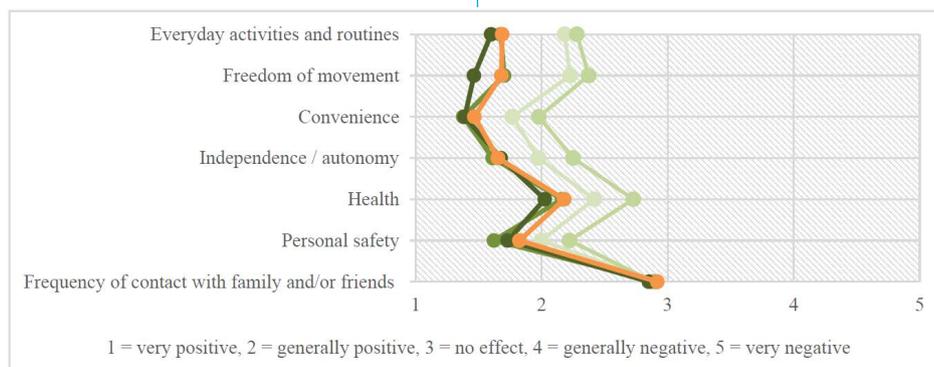


Figure 5: Effects of the solutions on the Living and Buildings field of application

Quantitative results

In this field of application, the data show a positive rating throughout almost all areas. Only *Frequency of Contact*, which is also not addressed by the solutions included here, receives a consistently neutral rating. All the other areas are given increasingly positive ratings during the test period.

Qualitative results

The qualitative data shows that test subjects really like the night-time lighting scenarios and that these also reduce their fear of falling. Access control using a radio key is considered convenient. Remote control for various facilities (e.g. heating or lighting control) is rated positively. The test subjects express their pride in having a house automation system. On the other hand, one criticism is that the lighting does not always work as desired. The new wall-mounted light switches also take some getting used to.

fined areas. In this field of application, the following technical solutions were presented as a group: various solutions for fall recognition and fall alarm, house automation solutions which act as fire, smoke or flood alarm, together with automated safety notifications.

Quantitative results

The solutions which are addressed in this field of application are aimed at the personal safety of the test subjects, which is reflected well in the quantitative data. In all areas, ratings are very consistent throughout the test period. The *personal safety* aspect stands out as being rated especially positively.

Qualitative results

In the qualitative results, the test subjects report that using safety solutions increases their feeling of personal safety. They do not want to do without the

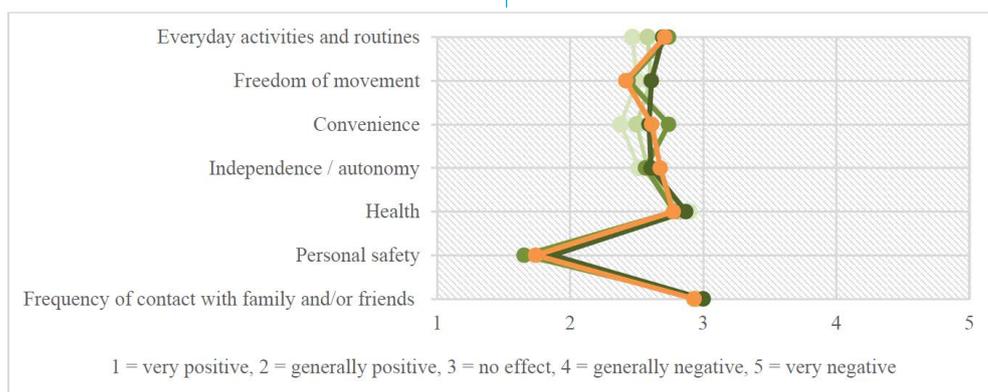


Figure 6: Effects of the solutions on the Safety and Protection field of application

The test facilities find it good that the scenarios are tailored to the individual needs of the respective test subject. It is also apparent that the test subjects are proud of using a house automation system. Any problems arising from the house automation systems could generally be solved by restarting the systems. Battery life has to be considered in radio-controlled systems, in order to ensure the functionality of the scenarios.

Effects of the Solutions on the Safety and Protection Field of Application

Here the test subjects were asked what effects the *Safety and Protection* solutions have on pre-de-

solutions any longer, because of the functionality these offers. These solutions also integrate themselves into the living environment and have no disturbing effect. Subjects find the emergency function very complicated, but this can be made easier with regular practice. The further recommendation of a safety solution within one test facility by a test subject led to the recruitment of a new test subject.

The test facilities reported that as a result of experience during the test period, changes in the configuration could reduce the number of false alarms. The positioning function of a safety solution works well and reliably. In one instance, the

smoke alarm integrated into the house automation system prevented the fire service having to be called. False alarms caused by pets are seen as a negative aspect.

Discussion

During the course of the 10-month test period, habituation effects are to be expected, which are reflected in the data results. This means that using the technical solutions leads to perceived normality, and the initial increased interest also wanes slightly. The distinctive design of the project lay in the fact that test subjects selected the technical solutions individually. No ready-made solution packages were offered, as packages were derived from combining individual solutions which met the requirements of the test subjects. For this reason, it is not possible to make any generalizable statements, but due to the methodical consolidation using tAALxonomy (2015), it was possible to achieve a larger random sample per field of application.

Experience derived from the whole course of the project is that the comprehensive involvement of a wide range of protagonists is required, in order to enable older adults to use the technical solutions regularly and in a useful way. This includes, for example, system developers, scientists (such as gerontologists) and various institutions (Marschollek & Künemund, 2014). Without the involvement of this group of people, older adult's use of the solutions would be more limited. However, it is the people close to the test subjects, such as relatives, friends or acquaintances, who play a vital role here, in that they have easy access to the target group, and can act as facilitators and helpers for older adults using modern technologies (Erickson & Johnson, 2011; Nägle & Schmidt, 2012).

One problem that can be ascertained in the way older adults deal with technical devices is the constant change in individual living conditions and environmental parameters. This concerns both the health and social conditions of older adults and the speed of technological advance. The coming together of the individual and technical solutions makes it difficult for a relationship between user

and technology to be created, and therefore this remains a challenge (Rodeschini, 2011).

An important finding - seen over the entire project period - turned out to be that the perceived emotions were relatively constant. It should be emphasized above all that the rating of all queried emotions was consistently on the positive side of the semantic differential.

From the qualitative statements of the test subjects, it can be established that the tendency is to rate the AAL solutions positively. In comparison, the ratings given by the test facilities are similar in many ways, but personal supervision is required, in the sense of giving advice, which is not perceived by the test subjects to the same degree.

Nevertheless, being confronted with modern technologies leads to an increase in cognitive competence. It gives the people who cited the need for safety as a reason for taking part in the project an enhanced feeling of safety, for example, such as in potential situations where they could fall, or when they are alone in their private living environment.

Using devices that support communication resulted in an expansion of communication activities. This meant for example that using Skype was adopted willingly, to contact relatives living far away and communicate with each other. However, it has to be noted that technically supported communication in no way replaces communication in person but is seen rather as an extension of this.

A gerontological finding became apparent with regard to the following conclusion: initial difficulties with using the technical devices were expected, as the target group was not regarded as being familiar with technology. However, it turned out and became clear that the people participating had actually had to deal with technical innovations in their previous life. Thus, the introduction of television, for example, or the increasingly widespread use of the telephone had effects reaching into people's daily routines and cultural and leisure habits. The automation of household devices such as washing machines or the increasing automation in cars also required people to get used to and adjust to technical innovations. These technical experiences and adaptive capacities should

not be underestimated and must be considered in future projects. The test subjects tend to be willing to accept and learn how to deal with technical innovations, rather than reject them.

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Appendix

Regular questionnaires had to be filled out at five collection dates during the test period of ten months. Due to changes in the participants' group (and concerning that, not all participants have completed all the ques-

tionnaires), the number of answers given is varying. With reference to the results in this paper, the following figures show the number of questionnaires filled out per collection date (questionnaires at collection date 1-5 = Q1-Q5)

Table-1: Emotions*

	Q1	Q2	Q3	Q4	Q5
anger / happiness	42	47	34	41	41
frustrating / motivating	42	47	34	40	41
annoying / pleasant	45	48	34	40	41
isolated / integrated	44	43	32	40	41
pointless / sensible	44	48	34	41	41
boring / interesting	44	48	33	41	41

* Note: Please indicate which of the following emotions you feel when using the solutions.

Table-2: Effects of the solutions on the Leisure and Culture field of application*

	Q1	Q2	Q3	Q4	Q5
Everyday activities and routines	21	21	18	17	8
Freedom of movement	20	19	18	17	8
Convenience	19	21	18	17	8
Independence / autonomy	20	20	17	17	8
Health	19	20	18	17	7
Personal safety	18	20	18	17	7
The frequency of contact with family and/or friends	20	20	18	18	8

* Note: How does the use of the technical solution XY affect the following areas?

Table-3: Effects of the solutions on the Information and Communication field of application*

	Q1	Q2	Q3	Q4	Q5
Everyday activities and routines	30	33	24	26	18
Freedom of movement	27	31	25	24	18
Convenience	30	33	25	24	18
Independence / autonomy	29	32	25	24	18
Health	27	32	25	26	19
Personal safety	27	32	25	24	17
The frequency of contact with family and/or friends	30	33	25	28	18

* Note: How does the use of the technical solution XY affect the following areas?

Table-4: Effects of the solutions on the Health and Care field of application*

	Q1	Q2	Q3	Q4	Q5
Everyday activities and routines	7	9	6	5	2
Freedom of movement	7	9	6	5	2
Convenience	7	9	6	5	2
Independence / autonomy	7	9	6	5	2
Health	7	9	6	5	2
Personal safety	7	9	6	5	2
The frequency of contact with family and/or friends	7	9	6	5	2

* Note: How does the use of the technical solution XY affect the following areas?

Table-5: Effects of the solutions on the Living and Buildings field of application*

	Q1	Q2	Q3	Q4	Q5
Everyday activities and routines	44	43	37	40	51
Freedom of movement	44	43	37	41	50
Convenience	43	45	37	41	51
Independence / autonomy	43	44	36	40	49
Health	43	44	37	40	50
Personal safety	44	45	37	41	51
The frequency of contact with family and/or friends	43	44	35	40	49

* Note: How does the use of the technical solution XY affect the following areas?

Table-6: Effects of the solutions on the Safety and Protection field of application*

	Q1	Q2	Q3	Q4	Q5
Everyday activities and routines	30	38	23	23	31
Freedom of movement	30	38	23	23	31
Convenience	29	38	23	22	31
Independence / autonomy	29	38	23	23	31
Health	29	38	23	23	31
Personal safety	29	38	23	23	31
The frequency of contact with family and/or friends	29	38	23	23	29

* Note: How does the use of the technical solution XY affect the following areas?