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The use of technology as an instrument to support the attention of the old persons and the possible increase of their autonomy

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Resumen

Este artículo pretende dar cuenta del impacto de un proyecto sobre nuevas tecnologías, de nombre ***Cordon Gris***, en las personas mayores. El proyecto está relacionado con la Tecnología de la Información y Comunicación (TIC) y la promoción del paradigma *Ageing in place*. El objetivo es la promoción de una vida independiente por parte de las personas mayores, así como prevenir la nutrición deficiente. En este trabajo se describen las principales estrategias desarrolladas para promover la aceptación, utilización, y por fin adopción de las TIC, y en particular la *APP Cordon Gris* entre los usuarios. El artículo presenta el proceso iterativo para diseñar el prototipo de aplicación *Cordon Gris*, y la importancia de la participación del usuario durante esta etapa através de las metodologías utilizadas. Argumentamos que dicha participación mejora la aceptación de la tecnología, aunque serán precisos cursos de apoyo y capacitación para asegurar la usabilidad entre los adultos mayores, especialmente en aquellos con bajos conocimientos de tecnología.

El foco fueron los 30 usuarios portugueses (entre los 63 y 87 años) que contestaron a cuestionarios previamente, y después de los 6 meses de formación. Los principales resultados demuestran que después de 6 meses de formación con entrenamiento una vez a la semana las competencias de las personas en el uso de la tecnología pasaron del nivel básico al nivel avanzado. No solamente utilizan la tecnología, sino lo que resulta más interesante, la adoptan, al verla cómo algo útil para sus vidas. Así podemos concluir que no obstante los pocos recursos educativos y económicos que caracterizaban a los participantes, su capacitación para el uso de la tecnología (smartphone) posibilitó una mayor participación social en la sociedad, aumentado así su calidad de vida e integración social.

Palabras clave: Personas mayores; envejecimiento; tecnología; atención a la persona; calidad de vida.

Abstract

This article intends to explain the impact of a project using new technologies on older adults named *Cordon Gris*. This project uses information and communication technologies (ICT) while promoting the "Ageing in place" paradigm with the aim to assist older people in maintaining a healthy and independent life, as well as preventing inadequate nutrition.

This paper describes the main strategies which were developed towards the acceptance, utilization, and finally, the adoption, of ICT - in particular, the Cordon Gris system.

The article also gives an account of the interactive process to design the *Cordon Gris* prototype, and the importance of the users' participation during those stages.

We shall argue that such participation has improved technology acceptance, although support and training courses have been needed to ensure usability among older adults.

The focus is here given on Portuguese users (between 63 and 87 years old) who answered questionnaires before and after the field trials. The main results showed that after 6 months of training with weekly sessions, these people's ability to use technology passed from the basic level to advanced one. They were not only able to use the technology on their own but, what is most interesting, adopted it as something useful for their lives. We can therefore conclude that however few educational and economic resources characterized the participants, their training enabled greater social participation, increasing thus their quality of life and autonomy.

Keywords: Older person, ageing, technology, social care, wellbeing

1. Introduction

This article intends to demonstrate how an institution with social responsibility in the city of Lisbon, that can influence public socials policies, thinks about the different ways to innovate its actions and tests new technologies as ways to improve its services and follow the evolution of the care services themselves. This institution is the *Santa Casa da Misericórdia de Lisboa* (SCML) that pursues humanitarian goals through social interventions that include health services and medical care, education and culture, as well as the promotion of quality of life, particularly for those most in need of protection. It is a social laboratory because it develops a social work in the areas of childhood, youth, family and community, and older persons, with facilities and services in each of Lisbon's neighborhoods to directly meet the existing social needs. Finally, SCML also conducts socio-economic studies and multidisciplinary research among the population.

The city of Lisbon is one of the city most affected by demographic changes. The social questions regarding ageing populations and the longevity oblige to contemplate new services and methodologies about care.

One way to innovate and improve our services has been by participating in the European Projects initiative Active and Assisted Living (AAL) in the scope of *Cordon Gris*[1] project. This was a consortium formed by end-users, business and research organizations from three European countries (United Kingdom, Nederlands and Portugal) and aimed to build and test a nutrition recommendation system based on budget.

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[1] http://cordongris.eu/

In this paper we focus on the results of the project in the Portuguese context given that it was an institutional challenge for the SCML to introduce new technologies with people that were not used to them. Moreover, Portugal was the country with the most participants.

Our goal wasn't only to understand how social organizations responded to a new situation, but also to understand the expectations of older persons regarding the mentioned topics.

2. Framework essentials

A huge concern for social organizations and policies is how to maintain older people autonomous in their dwellings for longer. And from the perspective of the 'ageing-in-place' theory, older people indeed prefer to stay in their homes as long as possible because it provides them with control over their lives, enabling them to keep their identity and well-being (Cutchin 2004). Relocation entails losing.

Concerning older persons, technologies could have an important role in different areas of life (e.g. physical and mental health, socials relations and leisure activities) (Schulz, Wahl, Matthews, Dabbs, Beach, & Czaja, 2014). Beyond the Information Communication Technology (ICT), other tools have been built, namely assistance technologies, aiming to increase and preserve the quality of life of older people, and informal caregivers too (Blaschke, Fredolino, & Mullen, 2009). It is expectable than in some situations when the patient is more dependent, technologies could be a fundamental help for monitoring their situation.

The *Cordon Gris* project was directly welcome the challenge since its aims is to assist older people in maintaining a healthy and independent life on a budget by providing meal recommendations, health monitoring and grocery shopping assistance. The solution helped users plan their meals and manage their budget without compromising the quality of their diet.

As we had already written in our initial proposal (Pereira et al 2015)" the data from January 2015 brought to light the fact that 1 in every 6 seniors reaching the emergency room are malnourished and those at risk of malnutrition are estimated to be as much as 2/3. Malnutrition can have serious consequences on one's health and independence. It is known today that malnutrition may cause depression and, on the other hand, studies also show that malnutrition is associated with cognitive function and dependence on others. Being unable to follow a healthy diet will most likely lead older people into a vicious cycle, where malnutrition and functional decline feed one another. Also noteworthy is the fact that older people are aware of the importance of food in keeping their independence. Fighting malnutrition, therefore, is one of the major steps towards promoting independent living and quality of life amongst community dwelling older people".

We began to see that the Internet of Things (IoT) is on our doorstep: many products coming out into the market have the ability of being connected and all these are generating data. Surprisingly, IBM estimates that "90 percent of all data generated by devices such as smartphones, tablets, connected vehicles and appliances is never analyzed or acted on".

The *Cordon Gris* prototype and services developed are thoroughly presented in (Ribeiro, Ribeiro & et al 2018). The system gathers and manages data that are relevant for this purpose (e.g. activity monitoring, country-specific food composition tables, retailers' information) and, by making sense of these data, the system generates recommendations that can balance healthy eating, physical activity and a budget constraint. Through a system with friendly user interfaces, Cordon Gris help users plan their meals and manage their budget without compromising the quality of their diet.

The goal of equipping older persons with a smart technology that empowers them to fight malnutrition by informing them about what type of food they should eat and in which quantities, was not the only goal of the project. Many of the prototype functionalities had for purpose to reduce the users' inputs to the minimum and automate a series of tasks in order to provide a real and tangible benefit for them.

3. Methodology : quantitative and qualitative

Two complementary types of methods were used in this study, on the one hand the quantitative methodology allows an extensive assessment of information, and, on the other, the qualitative methodology permits an in-depth analysis of some information obtained through the questionnaires.

The quantitative evaluation of the *Cordon Gris* system was organized in three moments: baseline protocol, intermediate evaluation (focus group and meeting group), and final protocol. The baseline questionnaire was given to participants that met the criteria to be part of this study, and it contained questions concerning: socio-demographic characteristics; health status; work and daily activities; information regarding nutrition and eating habits; experience, attitude and expectations towards technology. The final protocol aimed also to analyze the usability and acceptability of the system, and its impact in the daily habits of the participants.

In addition to the questionnaires and in-person monitoring of the participants during the field trials, the number of log-in's with the *Cordon Gris* server was also considered in the analysis.

During the field trials we tested three of the four services provided by the system: the meal planning, the groceries delivery, and the care home meals. The testing period was of around 6 months, with 46 participants (direct and indirect), and 26 older persons from the control group.

Communication between participants and the SCML was possible by phone and through weekly meetings taking place every Friday at the day-care centers. Such meetings were meant to monitor the experiment and to provide training and technical support to the participants. Additionally, SCML provided two workshops concerning nutrition and financial literacy, where participants had the opportunity to discuss the importance of the variety and seasonality of food for a healthy diet, the Mediterranean diet, food portions and saving strategies.

In total, questionnaires were performed in two different moments (with 110 people), at the beginning of the project to do a first evaluation of the knowledge of older people about nutrition, groceries and new technologies, and at the end we did the same questionnaires and compared its answers in two ways:

- Comparison of initial and final answers by the participants (baseline and final questionnaires).
- Comparison of final questionnaires of participants and the control group.

Qualitative methodology - focus group to receive the feedback of participants

Focus-group is one of the most important methods to get people's opinions and perspectives about an issue or a situation. This method is also used to evaluate programs or activities. Focus-group allows structured discussion, gradual sharing and clearing up of ideas.

In our case, we wanted to use this method to understand how participants evaluated the methodology of the technology training sessions.

During the transition from the first round of field trials (training in the use of smartphones) to the second round of trials (including groceries delivery) a focus group was realized with the aim to understand if the methodology, regularity and activities used during the training sessions were adequate.

Using the focus group for doing evaluation ongoing of the filed trials

i. The initial planning did not allow users to become fully autonomous. The methodology disregarded the potential of having smartphones in day-care centers;

ii. The training sessions did not meet all of the participants needs. It is a single solution for 30 different people;

iii. Little help from technical staff in some day-care centers;

iv. Generally, the training sessions were considered too shot.

The solutions applied by the project team from SCML were:

i. More emphasis on how to use the smartphones functionalities (especially for those users who were less confident);

ii. During the meal plan creation, users were split in two different groups according to their profile;

iii. More involvement of all the technical staff and directors;

iv. Tailored training sessions every Tuesday and Friday.

The aim of the focus group during the field trials was to monitor and improve the project team's actions and correct what was wrong or needed to be improved.

The project team from the SCML also used the strategy to organize an intergenerational activity to improve the self-confidence of the *Cordon Gris* participants in using technologies. The most distinctive feature of this intergenerational program was using technology as a mediator for intergenerational contact between elderly and students from Universities. In the contact session, older persons presented the *Cordon Gris* app and its different functionalities (meal plan creation and shopping list) and its usefulness for their everyday life. Students were invited to use the app as well. This intergenerational activity was a success, as the *Cordon Gris* participants felt confident and technologically integrated in society.

4. A good experience for older person- the Field trial Results

In this chapter the main results of the *Cordon Gris* project in Portugal are presented.

Portuguese field trials ran from October 2017 to May 2018. In the first phase the participants tested the meal plan and care home meals while in the second phase, the groceries delivery and shopping list creating were also tested.

Portuguese field trials involved a total of 72 participants, 46 in the experimental group (29 direct and 17 indirect participants), and 26 in the control group. In the experimental group we distinguished:

- Direct participant: person that used Cordon Gris, participated in weekly meetings, workshops and focus groups; filled in the questionnaire and the Mini Nutritional Assessment.

- Indirect participant: person that lived with a direct participant; filled in the questionnaire and the Mini Nutritional Assessment.

Each week, participants received a full shopping basket with the ingredients needed to follow the *Cordon Gris* meal plan.
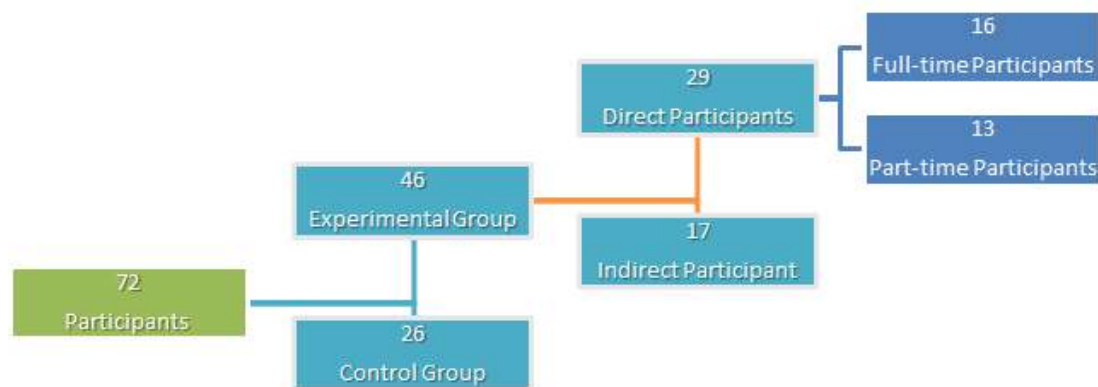
Figure 1: The sample of the Cordon Gris project

This figure presents the sample organization of the *Cordon Gris* project in Portugal. In a total of 72 participants, it is divided into experimental groups that include the direct participants who used the smartphone with the *Cordon Gris* application. Then we have the indirect participants that are made up of the people who live in the same house as the direct participants. These are in some way covered by the project since direct participants had to cook according to the suggestions given by the application.

It should be noted that the *Cordon Gris* recommendations adapts according the participants profile. So in the case of the full time participants who did not have their lunch in the day care centers, the application generated the plan for all of the week's meals. As for the part-time participants who had lunch in the day care centers, the application took into account those who ate lunch at the day center, and proposed other meals according to what they had eaten in the institution. The application was trying to adapt the plans not only to the food preferences of the participants but also to their routines.
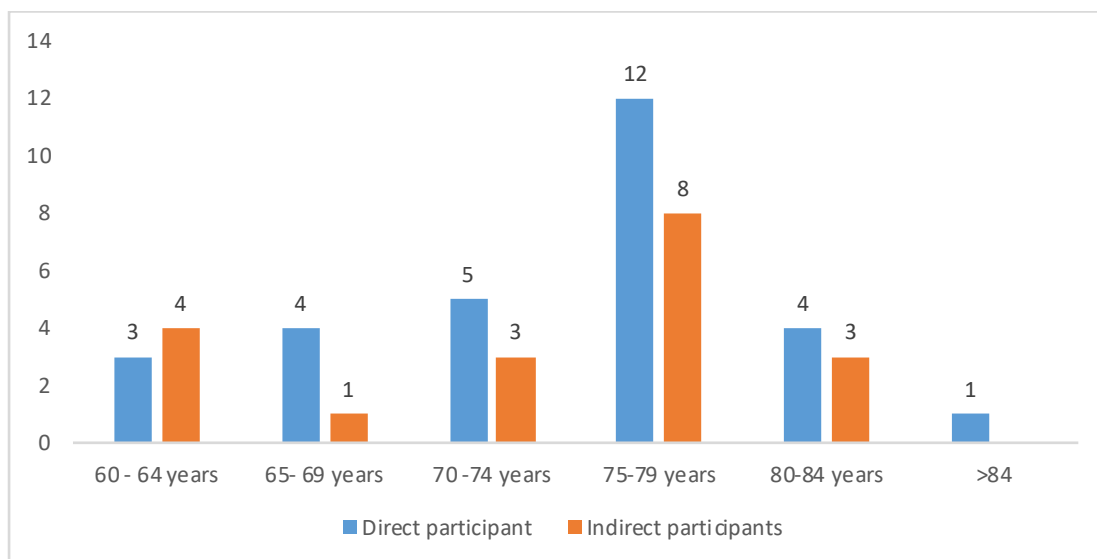
4.1 Particpants profile

Figure 2: Age profile of participants

Concerning the age of participants, it's interesting to check that most of them are 75 years and above. This situation is linked to the longevity of the population. The huge majority of the old people who used the social services belong the 75 years old age group and above.

The figure 3 depicts the participants' gender. In the 63 to 87 age group, women used to cook more than men. This could explain why we had more participant that were women than men.
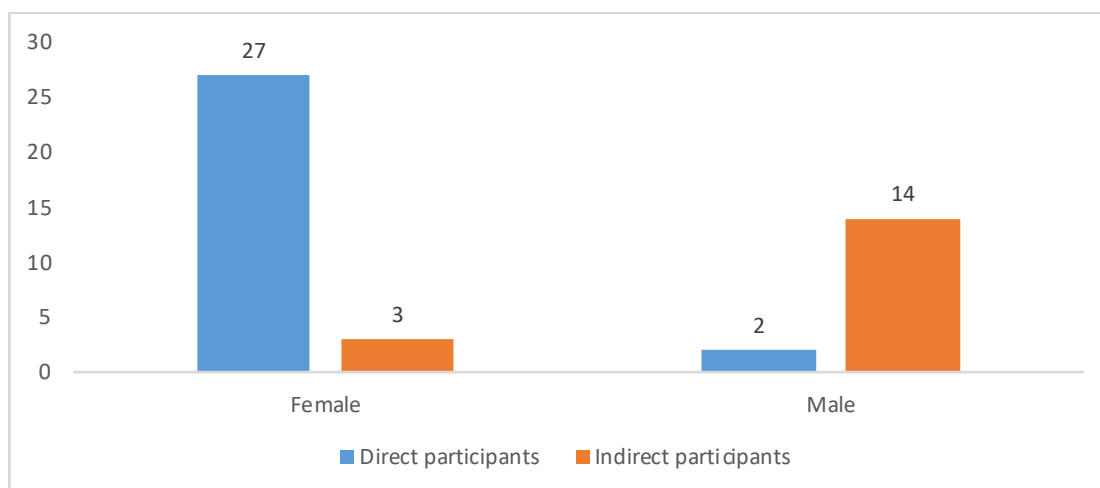
Figure 3: Gender of direct and indirect participants

When we analyzed with whom our *Cordon Gris* participants lived with, we observed that most of them lived with someone living alone. It can also be observed that the participants who lived with someone cooked more than the participants who lived alone.
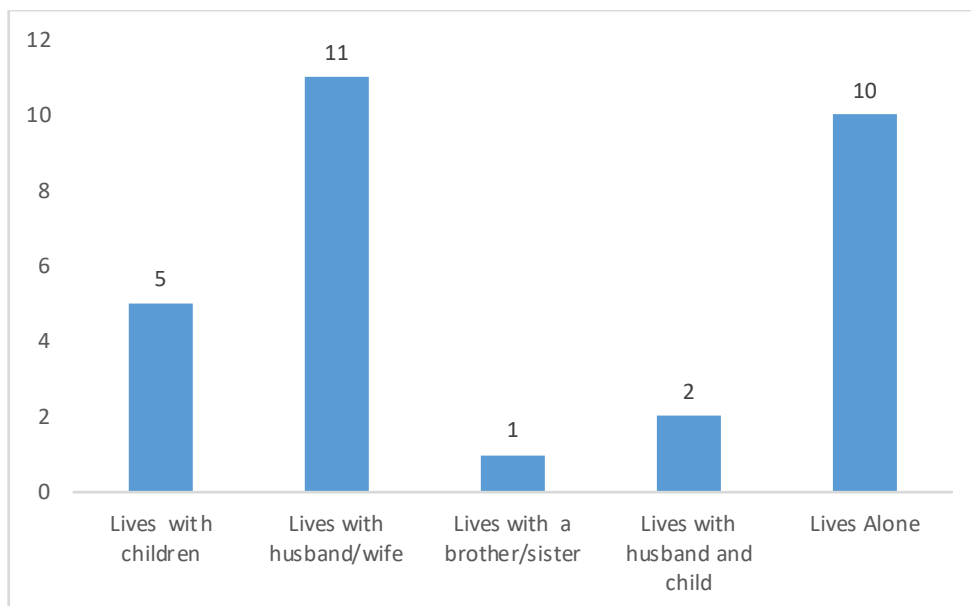

Figure 4: The participants lives with

4.2 Nutrition

Two important objectives of the field trials were to help participants eat healthier and tastier meals spending less, and also to make them more aware of nutrition. According to figure 5, the number of participants who did not eat morning snacks decreased by 6 after the beginning of the field trials.
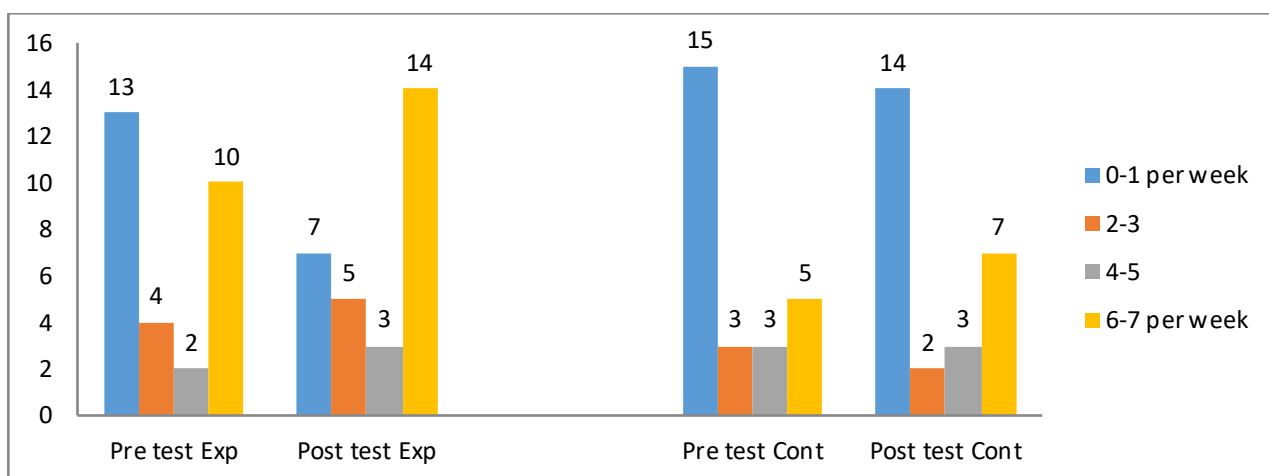
Figure 5: Eating habits: morning snack

Currently, 14 out of 29 participants from the experimental group eat morning snacks almost every day, and 13 out of 29 participants eat evening snacks almost every day (6-7). This change of habits can have very positive effects on older adults' quality of life because it helps to keep glycaemia at normal levels throughout the night.
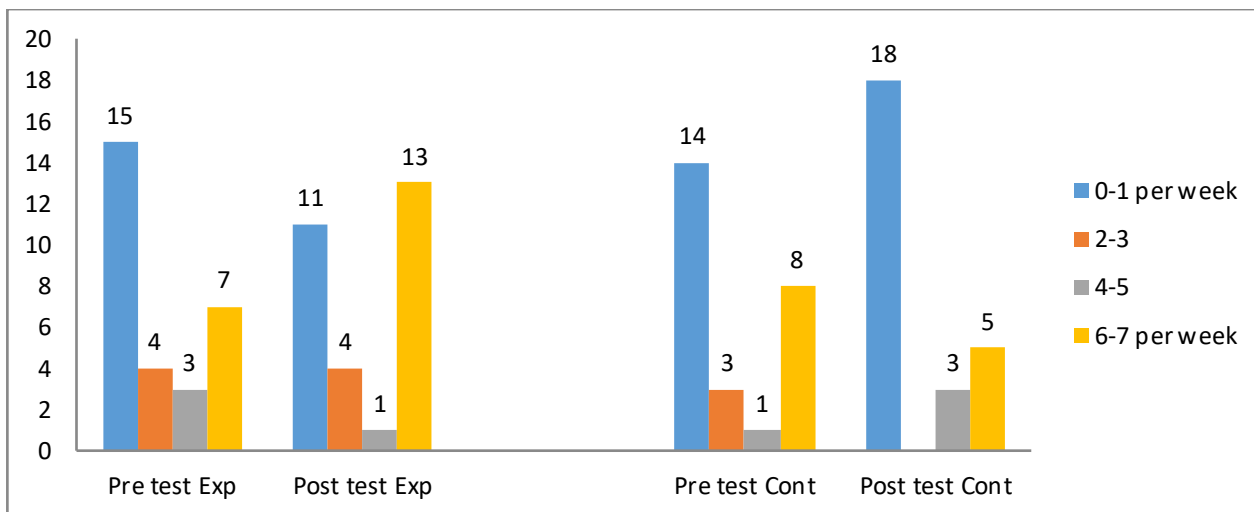

Figure 6: Eating habits: evening snack

We analyzed the practice of eating a snack at night before going to bed. When comparing the experimental and control groups, we found out that in the control group there were no changes regarding their food behavior, while in the experimental group, more participants started having snacks every day before bedtime. For this population, that sometimes have dinner too early or already have diabetes, eating a snack before bedtime prevents from spending so many hours on an empty stomach.

It's possible to check that people's interest in nutrition increase in the case of the participants in the *Cordon Gris* project. The figure 7 shows a clear increase of the participants' interest in nutrition: 28 out of 29 participants have an interest of 4 or more, with 15 having said that they have a very high interest.
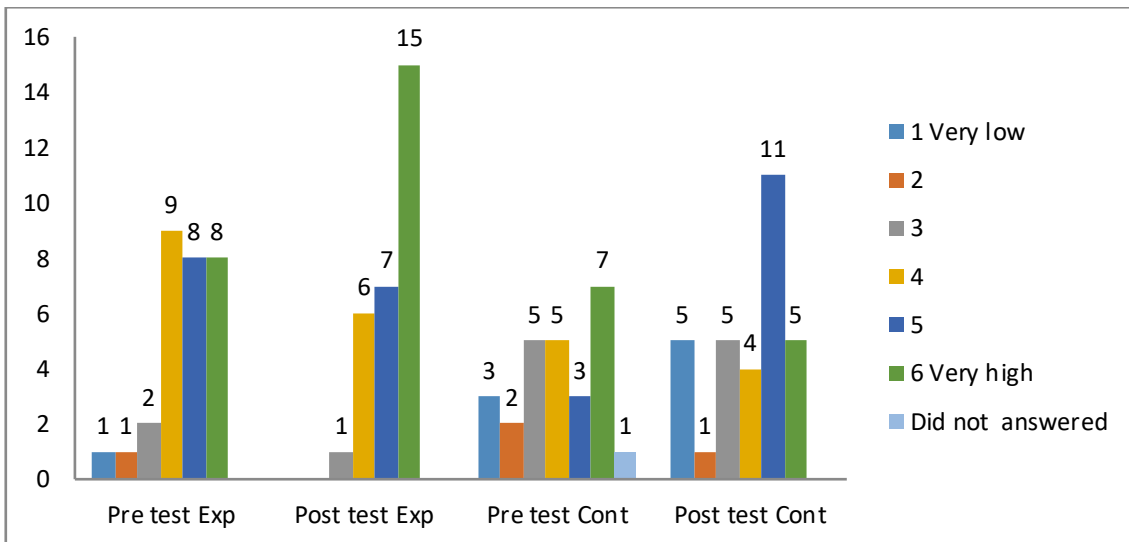
Figure 7: Interest in nutrition

Through the analysis of the meal plans created across the field trials, we have also verified:

- Wide variety of chosen products;
- Choice of healthier food products;
- Choice of less known food products.

All in all, there was a positive change of attitudes towards nutrition and also some changes of behaviors regarding healthy eating.

Participants are rather confident about the *grocery and meal delivery services.* 24 participants agree (17participants) or completely agree (7participants) that planning their shopping helps to control their spending habits. According to some participants, by sticking to what the system suggested, they could not get distracted with products that they did not need as they would be if they were shopping in a supermarket.
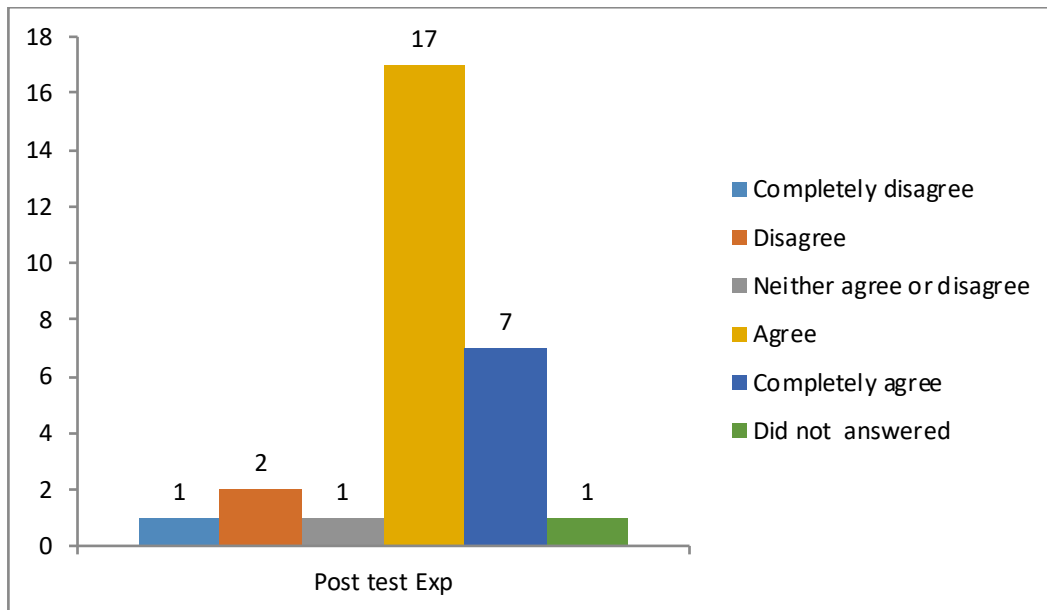
Figure 8: Grocery shopping practices

Shopping online and receiving it after was a very rewarding activity for several reasons. One of them is that for these participants whose average age is 77 years old, they experienced something that is usually associated with the young and adults who are too busy to go to the supermarkets. In addition, they found that it can be convenient every day.

In figure 9, we can see that the experimental group changed its shopping perspectives, while the control group maintained its habit of shopping at supermarkets.
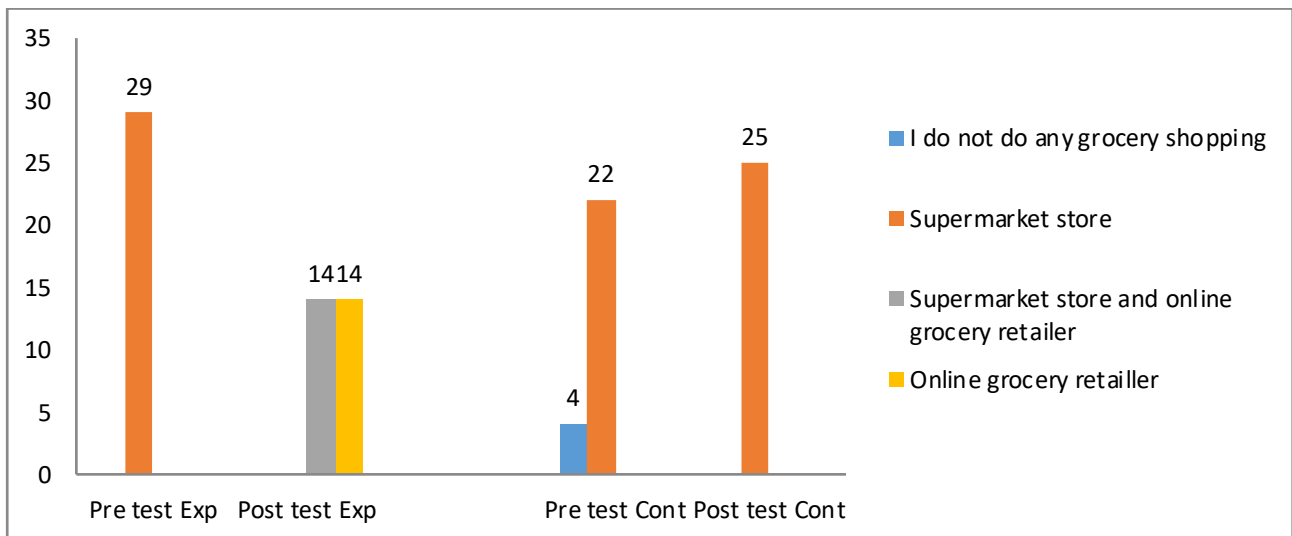

Figure 9: **Online shopping habits: spending**

Before the *Cordon Gris* field trials, the participants had ever shopped for groceries online. After the field trials, 14 users purchased exclusively online. According to most users, the greatest advantage of the *Cordon Gris* is to have all their meals planned. One does not need to think about what to eat and always knows what to cook for the next meal. Moreover, meal planning allows users to control their spending habits and save since they can buy ingredients only related to their meal plan, i.e. do not get tempted to buy other products. The grocery delivery service was described as a very convenient option that saves time and enhances people autonomy.
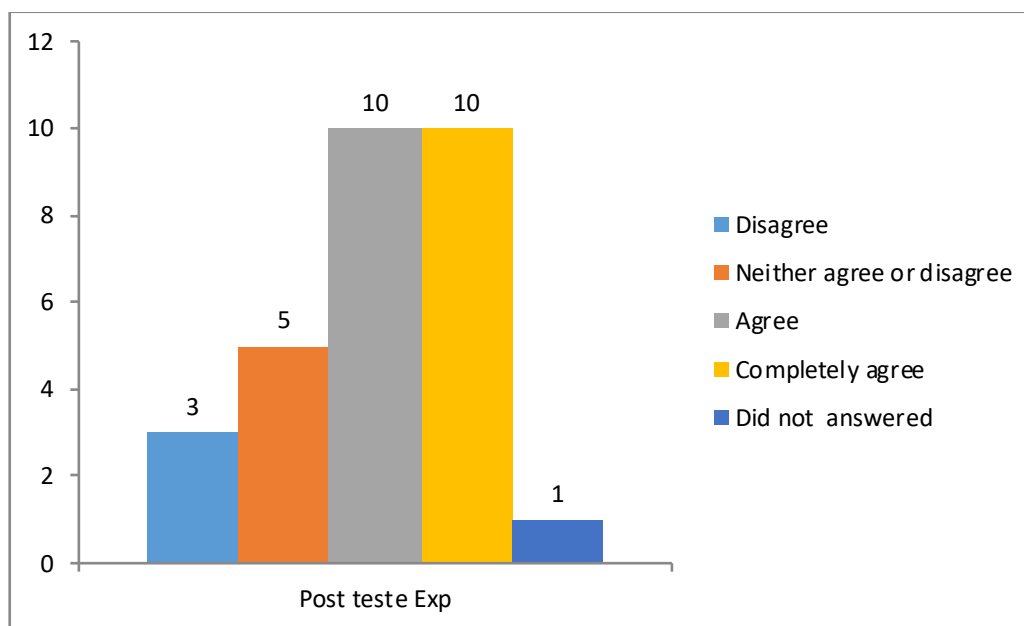

Figure 10: Online shopping habits: convenience

In figure 10, we may observe that 20 participants agreed (10) or completely (10) agreed that home deliveries were more comfortable than going to the supermarket. However, according to the figure 10, 8 participants would still prefer to go to a supermarket. This could be related to the fact that people do not get to choose their own products with the home delivery service. Another factor explaining this choice could be the fact that going to the supermarket for some of them is a moment for interacting with people, and talk with them.

4.3 Experience, interest and attitude towards technology

The experience itself is a significant factor of attitude-change, given that a negative emotional state is often cause by a lack of familiarity, whereas that greater use leads to decreased anxiety, increased confidence and interest regarding new technologies (Loyd & Gressard, 2014).

According to other similar studies, it is possible to list the factors that contribute to a greater acceptance and use of technologies, and define guidelines for effective teaching of competencies to be acquired in the use of ICT, which in turn leads to an increasingly comfortable knowledge, itself allowing more ease with the internet and computers or new technologies like smartphones (Czaja, Charness & Fisk et al., 2006 cited in Czaja, Lee, Branham, & Remis, 2012). In addition, the teaching of those new technologies must be individualized and comply with the needs of future users (Fisk et al., 2009; Czaja, Lee, Branham, & Remis, 2012). The perceived usefulness is a key factor for its adoption (Schulz, Wahl, Matthews, Dabbs, Beach, & Czaja, 2014 and Venkatesh & Bala, 2008).

In the pre-test, only 4 participants knew how to use a smartphone (figure 11). After the field trials, all users were acquainted with the technology. The most distinctive fact is that 15 out of 29 participants said that they currently use smartphones without any help. Training sessions played a major role in achieving such results. By providing ongoing support to participants across 6 months, they became more and more autonomous in using the *Cordon Gris* system and using its different functionalities.
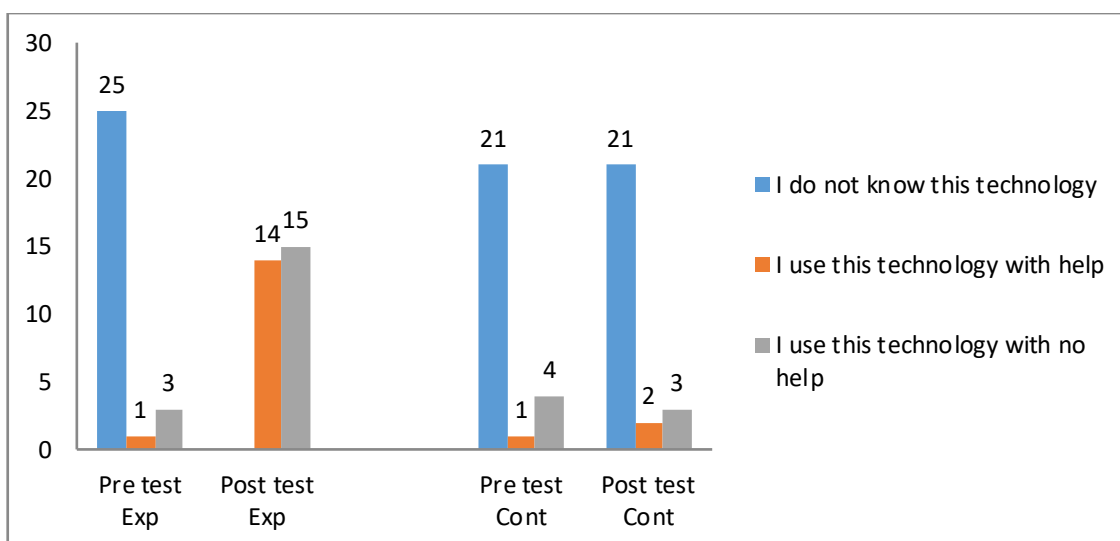

Figure 11: Familiarity with technology

In the light of the above, it is also interesting to note the increase of internet usage (Figure 12) among the participants with 15 people using it 3-4 times a week or more. The vast majority of the participants do not have access to internet at home, meaning that they mostly access internet in the day care centers.
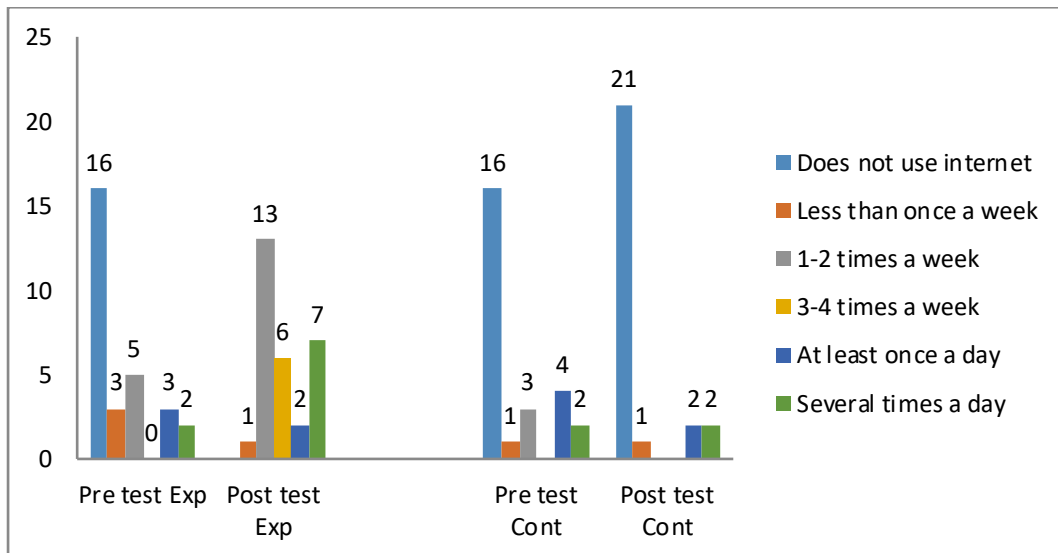
Figure 12: Internet usage frequency

Almost half (14) of the participants said they used smartphones to play games and 12 to look for information. From these data, it is reasonable to say that participants adopted smartphones in their everyday life and not only used it for the purposes of the project.
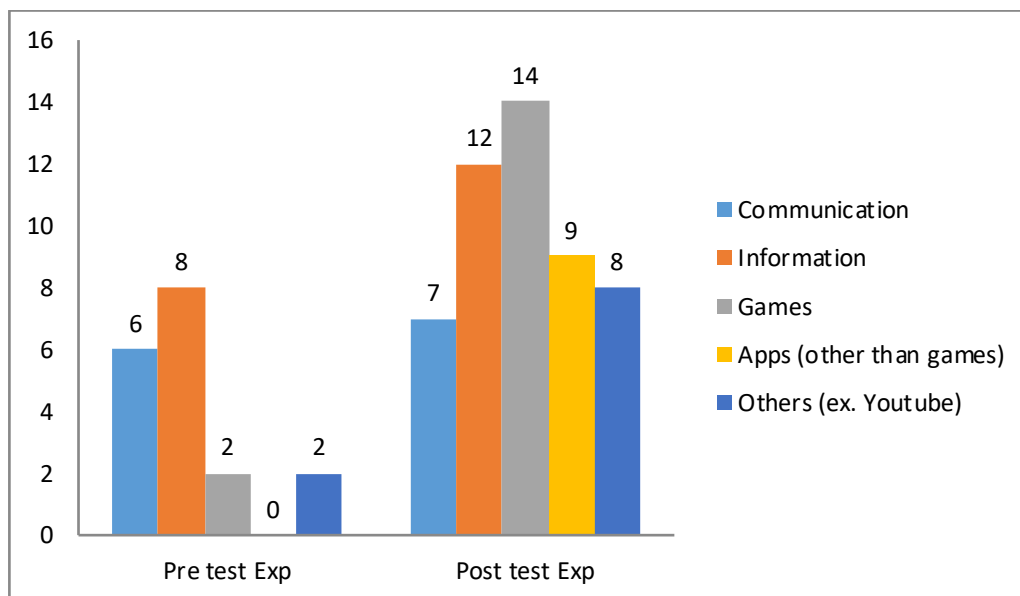

Figure 13: Type of internet usage

The *Cordon Gris* field trials had a great impact on Portuguese users since it enabled their acquaintance with information and communications technologies. As a result, when participants were first asked what the role of technology in their lives was, the majority mentioned "learning" and "entertainment". Many participants also mentioned that technology stimulated their "cognitive faculties", "wellbeing"

and "security". Users also reported that using technology gave them a feeling of "being updated" and "being ahead of their time". The *Cordon Gris* services were also identified as enhancers of the users' wellbeing because it provided them with information on nutrition and/or healthy eating.

Some participants said the *Cordon Gris* app could be used by active people, whereas others mentioned it was best suited for inactive single people with little mobility. One user mentioned that the *Cordon Gris* application is best suited for families since it is not reasonable to ask someone who is single to cook so many times per day. Views also differed in terms of the level of education required to use the *Cordon Gris* application, e.g. low or high level of schooling. Some users thought the *Cordon Gris* application could be used by a wide range of people, from young to older adults. One user mentioned that it could be a great tool for nutritionists because it would help them to save time in preparing nutritional plans.

To evaluate the usability of the Cordon Gris system, the System Usability Scale (SUS) questionnaire was performed at the end of the field trials. A version with a positive formulation of the questions was used, and the SUS responses were processed according to the SUS calculations with the formula adjusted to the positive scale. The mean score for Portugal was 72.9 points, which placed it in the 'acceptable but with space for improving' category.

Conclusions

Throughout this project, it is possible to get the suggested menus from the *Cordon Gris* according to the participants' food preferences, while keeping a healthy diet. On the other hand, the project partners who made the purchase deliveries had to understand these new users' profile, and it could be a good opportunity for big companies that do grocery delivery to rethink the delivery personnel's training.

Although the application was strictly designed for the age group of 65 and over, the participants believed that healthy eating should be for all age groups. The *Cordon Gris* gave them a feeling of social integration, because they would use the same technology as their grandsons'. One conclusion is that technology can also be adopted in segment of the society.

The participants of the *Cordon Gris* project were woman with an average age of 77 who lived with someone. These women were responsible for the groceries and cooking at home. It is interesting that the *Cordon Gris* application gave to these women more autonomy and self-confidence. Usually, their husbands decide most issues at home.

As main disadvantages of the *Cordon Gris* application, users identified its rigidness which reduces creativity and its lack of integration, e.g. the application does not allow to check prices and it does not promote physical activity. Also it is not possible to undo an action when the shopping list is already created. Some disadvantages were related to the prototype's functioning, and could be overcome in the future.

Users were very pleased with the continuity of their participation across the project. They highlighted the good planning of the field trials, and reinforced the importance of defining clear objectives for any activity.

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