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CSR practices in a Telecomm Company: Information and Communication Technologies (ICTs) for Elderly Healthcare Management in Portugal

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Abstract

The phenomenon of population aging is resulting in a global demographic change, a consequence of an unbalance relationship between life expectancy increase and low birth rates, where the United Nation Report positions Portugal as the 4th oldest country in the world by 2050.

Living longer does not necessarily mean living better. The Portuguese Public Healthcare system is facing sustainability challenges to provide the necessary assistance to an increasingly older population, with unsustainable hospitalizations costs related to chronic uncommunicable diseases. Domiciliary health assistance is a viable solution for this, if an efficient health monitoring assistance is provided, hospitalizations would be prevented.

Information and Communication Technologies (ICTs) applied in the healthcare sector as telemedicine can have an important role not only improving healthcare assistance but also allowing new forms of information sharing and communication through distance, reducing elderly isolation.

This project was developed in partnership with Altice Portugal, as an in-company project, with the objective to provide improvement recommendations for the ICT solution that company is developing for elderly domiciliary healthcare management, that includes remote monitoring of vital signs.

For that, a conceptual framework was developed in order to schematize the relationship between the variables that influence Elderly Use and Acceptance of Health ICTs, using a face-to-face questionnaire tool to a group of 142 participants. This research permits to understand the importance of Healthcare ICTs, identifying the existing innovations and future trends.

Key Words: Sustainability, business Sustainability, Elderly, Health, Technology

JEL Classification: I115(Health and Economic Development), O32 (Management of Technological Innovation and R&D), O33 (Technological Change: Choices and Consequences • Diffusion Processes)

RSE numa Empresa de Telecomunicações: Tecnologias de Informação e Comunicação para a gestão da Saúde da População Idosa em Portugal

Rui Carlos Calado Fernandes Dias

Resumo

O fenómeno do envelhecimento da população está a resultar numa mudança demográfica global, resultado de relação desequílibrada entre o aumento da esperança média de vida e baixa natalidade, onde o relatório das Nações Unidas positionou Portugal como o quarto país do mundo mais envelhecimento em 2050.

Viver mais anos não significa necessariamente viver melhor. O Sistema de Nacional de Saúde Português (SNS) apresenta alguns desafios de forma a proporcionar a devida assistência a uma população cada vez mais envelhecida, registando custos de hospitalização insustentáveis associados a doenças crónicas relacionadas com o envelhecimento. Muitos destes casos de hospitalização podem ser prevenidos através de uma monitorização eficaz da saúde, sendo a assistência ao domicilio umas solução viável.

A aplicação de tecnologias de informação e comunicação (TICs) no sector da saúde, como por exemplo a telemedicina, podem ter um papel importante, não apenas melhorando a assistência de saúde, bem como permitindo novas formas de partilha de informação e comunicação à distância, reduzindo o isolamento dos idosos.

Este projecto foi desenvolvido em parceria com a Altice Portugal com o objectivo de dar recomedações de melhoria para a solução TIC que a empresa se encontra a desenvolver para melhorar o apoio domiciliário a idosos, incluindo o controlo remoto dos sinais vitais. Com esse intuito, um modelo conceptual foi desenvolvido de forma a esquematizar a relação entre as variáveis que podem influenciar o Uso e Aceitação das TICs na saúde por parte dos idosos, através de questionário presencial a um grupo de 142 participantes.

Palavras-Chave: Sustentabilidade, Idosos, Saúde, Tecnologias

JEL Classification: I115 (Saúde e Desenvolvimento Econômico), O32 (Gestão de Inovação Tecnológica e P&D), O33 (Mudança Tecnológica: Escolhas e Conseqüências • Processos de Difusão)

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Em forma de agradecimento, partilho algumas palavras dedicatórias a todos aqueles que me acompanharam na conclusão deste projeto de tese, que representa uma etapa importante, a conclusão do meu mestrado.

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Este projeto não teria sido possível sem o apoio da Universidade Sénior Dom Sancho I, Universidade Sénior Moita. Universidade Sénior Amadora (CUTLA, Universidade Sénior Marvila, Lar Estrelícia Rosa, Lar Momentus Senior e Residência Senior DomusVida que me abriram as suas portas possibilitando a implementação do questionário aos seus estudantes e utentes, que demonstraram receptividade positiva para participar no estudo.
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Conceptual Model- Usefulness Expectancy (Acceptance of Health ICTs)

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Abbreviations

5G	Fifth generation wireless
CSR	Corporate Social Responsibility
CUTLA	"Universidade Sénior da Amadora"
Eurostat	European Statistical Office
GDP	Gross Domestic Product
GPS	Global Positioning System
Health ICTs	Health Information and Communication Technologies
ICTs	Information and Communication Technologies
ISCTE	Instituto Superior de Ciências do Trabalho e da Empresa
IUL	Instituto Universitário de Lisboa
OCDE	Organisation for Economic Co-operation and Development
PORDATA	Contemporary Portugal Database
SDG3	Sustainable Development Goal 3: Healthy lives and well-being
SDGs	Sustainable Development Goals
SmartAl	Altice´ "Smart Assistance Living" Platform
SNS	Sistema Nacional de Saúde de Portugal
SPSS	"Instituições Particulares de Solidariedade Social"
UN	United Nations
UTAUT	Unified Theory of Acceptance and Use of Technology

Chapter I - Executive Summary

This in-company project aims to solve a challenge regarding Corporate Social Responsibility (CSR), in partnership with Altice Portugal and Altice Foundation, providing improvement recommendations for the recent platform that the Altice developed in the Healthcare sector for domiciliary elderly healthcare management, "SmartAl-Smart Assistance Living". To develop valid recommendations, a face-to-face questionnaire was applied to a group of 142 Portuguese participants aged 60 years and older, visiting elderly homes and senior universities, with the aim to understand Elderly Use and Acceptance of Health ICTs. Additionally, the literature review presented in this research identifies the most relevant Health ICTs and future trends.

In this project had the opportunity to visit Altice Labs in Aveiro, meeting with Altice Innovation team leader that presented the platform concept. By understanding that each patient has specific health needs, SmartAl´ software architecture was built to be easily connected to different devices in home and programmed according each patient profile, permitting remote monitoring of vital signs in home, as well as provide notification and alarms for facilitating health management. The aim of this solution is to connect all the stakeholders (patients, health professionals, formal and informal caregivers) to improve communication and information sharing.

The first step of this research was to analyze the existing literature regarding corporate social responsibility in the Telecommunication Industry and the dimensions in which this companies can have an important role in society, identifying the opportunity to scope the research regarding the application of ICTs for Elderly healthcare management, as an answer for the Portuguese public healthcare challenges due to population ageing.

In order to understand Elderly Use and Acceptance of Health ICTs a conceptual framework was developed, being composed by eight hypothesis and two research questions, one regarding Elderly´ Acceptance of Health ICTs and the second the use. This framework was based in the Unified Theory of Acceptance and Use of Technology – UTAUT (Venkatesh, et al., 2003). Concerning Acceptance, usefulness expectancy is the variable with a stronger Pearson correlation (0.932), followed by effort expectancy (0.880), social influence (0.725) and lastly with a moderate relationship Information Security and Privacy (0.566). Even effort expectancy due to lack of digital skills can have a negative influence, as well as concerns regarding information security and privacy, the most important for a positive acceptance is to understand that Health ICTs can be useful to improve health management. Additionally, the

support of important people as family can play a social influence that contributes for a positive acceptance of Health ICTs.

The Use evaluation of Health ICTs is strongly influenced by the variable health benefit (0.874). This meaning, if the use of this technologies results in an improvement on health quality, the use evaluation will be positive. Furthermore, usability (0.837) and access to assistance (0.754) have also a strong relationship to use evaluation. Health ICTs should be intuitive and access to assistance is fundamental for a good use of Health ICTs. Even with a moderate relationship, lack of access to Health ICTs (0.754) can have a negative influence, being important that the necessary tools and technologies are provided.

The questionnaire also permitted to understand that ICTs are important in elderly routines, where in a group of 142 only one don´t use any technology, being a resident in an elderly home and having the necessary assistance. Even between older elderly it is common that they use one or two basic ICTs, as landline phone or television, being important for facilitating the communication with family and friends, as well for entertainment, reducing isolation. It was possible to notice a difference between elderly generations and technology familiarity, where participants aged between 60 to 70 years are the one use more advanced ICT as smartphone, computer or tablet. Additionally, the use of computer and tablet is more common between participants with higher education level, qualified and intellectual professions. About gender, there is a higher percentage of women using computer and tablet. The visit to senior universities permitted to notice that with the necessary assistance elderly can feel curious to use technologies.

As result of the research the improvement recommendation for the SmartAl Platform would be to include a chat assistance service, an emergency alarm and even fall detector using a smart bracelet or pendant, cognitive training games stimulating memory and concentration as well as detection of dementia cases, a functionality for screening sleep quality monitoring insomnia and stress, a voice bot command so elderly could easily communicate by voice instead of typing. Finally, as a recommendation for the concept of the platform itself, it would be interesting to include a gamification concept, rewarding with points if tasks are completed and stablishing goals, could increase their motivation to keep using this technology.

Even today´s elderly generation still facing problems using technologies, future generations will manage their health in a different way. Telecommunication companies have the social responsibility to develop solutions that answer to society challenges as SmartAl platform, promoting healthy ageing by improving domiciliary healthcare management

Chapter II - Exposition of the context of the issue

Technology and medicine advancements have been contributing to improve life expectancy, although together with a low birth rate in developed countries have been resulting in population decline and ageing. Portugal is the 4th European country with higher percentage of the population aged above 65, 19,9% and according European commission this percentage tends to increase to 22% in 2060[1]. Today´s demography change has resulted in an increase in pensions dependents, lower youth employability and older workforce, higher taxes, emigration and representing a challenge to public health system, with an increase in chronic diseases, mental disorders and need for domiciliary assistance.

Information systems, telemedicine or teleassistance are example of ICTs that have been implemented in **senior patient's** healthcare management for vital signs remote monitoring, cognitive training, communication with medical professionals, daily tasks management and access to health information for an independent healthy living. ICTs permits **Family and Friends** to better informed regarding relative's health and alerted in case of emergencies, **Formal caregivers** to improve teams 'tasks management and automatic reporting to family and **doctors** to have more completed medical information, easily communicate and automate workflow. According Direção-Geral de Saúde (2014)[2], in 2012 the hospitalization of people aged 65 or more represented 50,53% of total costs, that can be reduced by improving diseases prevention and monitoring of senior citizens, especially in rural areas.

Telecommunication companies CSR in healthcare is fundamental, providing knowledge and resources to promote senior citizens healthcare management, in collaboration with all stakeholders, increasing customers retention and brand recognition by making the difference.

Figure 1 – Stakeholder´s map - Domiciliary Healthcare Management

[1] https://ec.europa.eu/info/sites/info/files/economy-finance/ip065_en.pdf
[2] https://www.dgs.pt/estatisticas-de-saude/estatisticas-de-saude/publicacoes/portugal-idade-maior-em-numeros-2014.aspx

Chapter III - Literature Review

1. Corporate Social Responsibility (CSR) and Sustainable Development

The concept of Sustainable Development was first introduced by World Commission on Environment and Development (1987) in "Our Common Future"[3] as the "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Four thresholds were identified as essential: environmental sustainability, satisfy basic needs and equity between generations. (Daly, 2007) cited by (Holden, Linnerud, Banister, 2014)

1.1. Sustainable Development Goals (SDGs)

In 2015, the General Assembly of the United Nations (UN) formally adopted the Sustainable Development Goals (SDGs)[4]. A set of 17 goals, 169 targets and 230 indicators were established as 2030 agenda for Sustainable Development. This should be an adaptative process that involves trade-offs and the interlinkage between three different systems: environmental system, economic system and the social system. This research will emphasize the health dimension, studying in the following chapters how telecommunication companies can develop new technologic solutions to promote healthy lives and well-being (SDG3)[5], focused on senior citizens.

1.2. Corporate Social Responsibility in Telecommunication Industry

Engage in a Corporate Social engage in CSR means that, in the normal course of business, a company is operating in ways that enhance society and the environment and is self-regulating business model that helps a company be socially accountable to stakeholders and the public. (Investopedia, 2018)[6].

Pistoni, Songini and Perrone (2015) analyzed "Why" and "How" telecommunication operators in Europe engage in CSR and sustainability approach, concluding that the "Why" is related to institutional reasons for society acceptability of the company, to improve organizational adaptability and fit to external environment, as regulatory framework or stakeholders pression, and to implement an ethical code of conduct. The authors refer that the implementation of a CSR strategy is a complex process and the "How" depends on the

[3] https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf
[4] https://sustainabledevelopment.un.org/?menu=1300
[5] https://sustainabledevelopment.un.org/sdg3
[6] https://www.investopedia.com/terms/c/corp-social-responsibility.asp

organizational factors as internal structure and roles, firm ownership, company size and managerial systems and the corporate strategy as initiatives and activities implemented.

The research paper of Özturk and Marsap (2018) analysed the principal telecommunication operators in United States, United Kingdom, and Turkey and identified seven relevant issues: Ethics, Customer Care, Care for Employees, Stakeholder's Involvement, Environmental Care, future Goals and Awards and the importance of community involvement in education, energy, healthcare, ethics, employment, sponsorships.

1.3. CSR and Corporate Foundations (ALTICE and AlticeFoundation)

It is frequent that multinational companies create Corporate Foundations for managing their CSR and philanthropy investments, ensuring the allocation of funds to the most relevant issues independently of the company governance, guaranteeing transparency (The Guardian, 2007)[7].

ALTICE commitment to CSR and community involvement is managed by AlticeFoundation, pursuing independent activities, without direct legal and strategical control. In 2015, at that time names as "FundaçãoPT", the foundation invested 4 million euros in the support of 200 organizations and more than one million people. (PT Telecom, 2016).

2. Importance of Information and Communication Technologies (ICTs)

Information and Communication Technologies (ICTs) refers to the wire, cable or wireless communication transmission and information treatment, including hardware, network, mobile phones and software. A literature research was conducted in this chapter to understand the importance of ICTs for economic and social development.

2.1. ICTs Economic Importance

Gruber and Koutroumpis (2011) assessed a high correlation degree (0,54) between the number of mobile telecommunication lines and economic growth. The authors mentioned that due to a lower number of communication lines in underdevelopment countries the impact is 0,11% on economic growth, inferior to the 0,20% annual GDP growth of high-income countries. In 2009, 67% of the world population subscribed this service in 2009 representing also an important mean of tax collection. Trough case studies analysis, the authors evidence that mobile telecommunication technologies can also lead to productivity growth. Communication through distance and information sharing permits to increase productivity and reduce costs. Also,

[7] https://www.theguardian.com/sustainable-business/comapanies-csr-policies-corporate-irresponsibility-new-study

mobile phones permitted to create new business solutions, for example mobile shopping or money transfer thought mobile phones.

2.2. ICTs Social and Well-being Importance

Ganju, Pavlou and Banker (2016) were the first to analyze the relationship between ICT use in tree variables (fixed telephone lines, internet users and mobile phones) and the level of social well-being. The conclusions indicated that in developing countries, as Africa and South Asia, the mobile phone use have a strong impact in well-being, indicating lower access to fixed lines and internet. In developed countries, both tree variables influence well-being. In this research well-being was analyzed regarding social capital and equality, health, education and commerce. Telephones can have a positive impact in healthcare, reducing depressions, increase immunization rates, clinics attendance and providing health information for disadvantage groups. ICT enables educative information sharing and the use of new resources, including computer courses and online videos. Additionally, ICT can promote new jobs creation and eliminate inefficiencies from supply channel, providing market information regarding prices and making possible online shopping.

Deloitte (2014) argued that access to internet connectivity could provide cost effective educational online resources for 640 million children, 140 million new jobs, remove 160 million of people from poverty, potentially saving 50.00 children's and reduce in 7 percent infant mortality in developing countries by informing the best pregnancy practices.

Even ICTs are often considered a second priority for developing countries, it can have direct impact in primary bases of a society as health and education, reducing cost and improving performance. (Jensen, 2007 cited by Gruber and Koutroumpis, 2011).

3. Use and Acceptance of ICTs

Over the past few years different authors dedicated to understanding the determinants that influence the acceptance and use of technologies, being necessary to strengthen the basis of this research with a unified model that develop a longitudinal study of the similarities and differences between the eight more relevant models, in this case the Unified Theory of Acceptance and Use of Technology (UTAUT), by Venkatesh, Morris e Davis (2003). The authors empirically validated that this model can explain 70 % of the variation of the technology intension of use.

3.1. Unified Theory of Acceptance and Use of Technology – UTAUT

Over the past few years different authors dedicated to understanding the determinants that influence the acceptance and use of technologies, being necessary to strengthen the basis of this research with a unified model that develop a longitudinal study of the similarities and differences between the eight more relevant models , in this case the Unified Theory of Acceptance and Use of Technology (UTAUT), by Venkatesh, et al., (2003). The authors empirically validated that this model can explain 70 % of the variation of the technology intension of use.

Venkatesh, et al., (2003) refers that "UTAUT thus provides a useful tool for managers needing to assess the likelihood of success for new technology introductions and helps them understand the drivers of acceptance in order to proactively design interventions (including training, marketing, etc.) targeted at populations of users that may be less inclined to adopt and use new systems." (Venkatesh, et al., (2003, page 425 and 427).

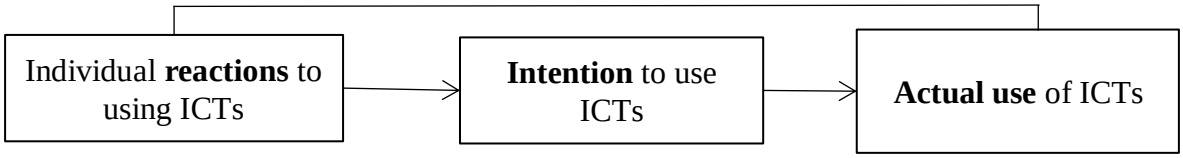


Figure 2 – ICTs Acceptance Process. Source: Venkatesh, et al., (2003), page 427.

In this study, the UTAUT model (presented in figure 3)will be used to measure the use and acceptance of technology to promote a better health condition by the senior segment in Portugal. This model indicates the 4 significant determinants that influence the acceptance and usage behavior, namely performance expectancy, effort expectancy, social influence and facilitating conditions and 4 moderators, gender; age; experience and voluntariness of use.

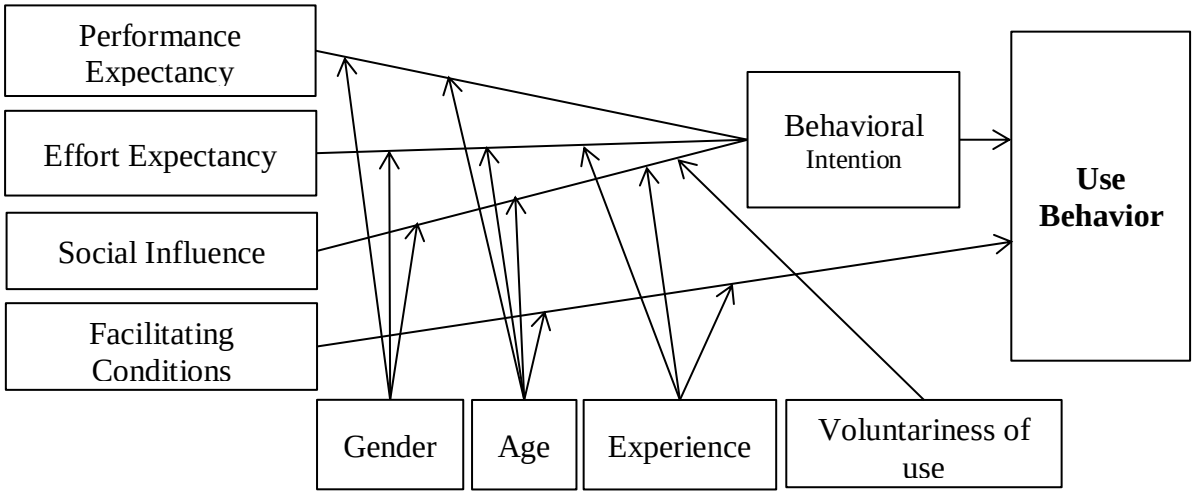


Figure 3 – Conceptual Model of the Unified Theory of Acceptance and Use of Technology. Source: Venkatesh, et al., (2003), page 447.

According to the analyze of Venkatesh, et al., (2003), page 447 to 456, the Figure 2 summarizes the formulation of the UTAUT conceptual model, resuming the constructs and the items under analyze;

Performance expectancy can be divided in 3 constructs, Perceived Usefulness**:** Technology systems can help me to complete routine tasks more quickly, facilitate my job, increase the quality and quantity of the work for the same amount of effort, Extrinsic Motivation**:** Influence of incentive pay, promotion or other external motivation to increase performance and Job-fit: perception of the system capabilities to improve individuals work. Influenced by gender and age moderators, the research shows that Men in young age have a stronger performance Expectancy.

Effort expectancy can be divided in 3 constructs, Perceived ease of use**:** believe of how easy it will be to use the system (learning how to operate, program the system, interaction experience), Complexity of the system: believe of how intuitive will be to use the system, simplicity of operation Perception and time needed to learn and use the system, Ease of use: perception of how easy it will be to use the system. Influenced by Gender, Age and Experience, Effort Expectancy research shows that effort expectancy will higher for women in older ages with little experience using this type of technological system.

Social Influence can be divided in 3 constructs, Subjective Norm**:** Influence when important people for the elderly promote that they start using, Social Factors**:** Influence of people that already use the system and having someone to support in case of problems using the program, Image: perspective that using technology can enhance status image and recognition. Influenced by Gender, Age, Experience and Use Voluntariness of use, research shows Image has a stronger influence in older women, in the early stages of experience

Facilitating Conditions can be divided in 3 constructs, Perceived Behavioral**:** Perception of having the necessary knowledge, resources, opportunities and compatibility to start ICTs, Facilitating Conditions: Availability of assistance in case of difficulties, instructions and guidance, Compatibility: compatibility with values, needs and experience. Influenced by Age and experience, research shows facilitating conditions will be higher in older workers with more experience

3.2. Other factors that can Influence Use and Acceptance of ICTs

According Pal, Funilkul, Vanijja and Papasratorn (2018) research, security and privacy can also negatively influence attitude towards the use of technology. This group of population have

in general reduced experience using technology, having a natural aversion and lack of trust in providing personal information, being an eventual barer.

This research also shows that compatibility, satisfaction, enjoyment and affordability can influence behavioral intention for elderly technology use. **Compatibility:** Due the multiple manufacturers of Devices and application, compatibility can be a concern, specially to elderly people that are in general not technology advanced users, affecting user´ satisfaction and intention to use this system. This system needs to be capable to communicate and interpret multiple devices and protocols, creating a network. **Satisfaction:** Elderly people have a lower familiarity with technologies and are late adopters of innovations, where more user´s overall satisfaction using this technology will be important for them to use health ICTs. **Enjoyment:** An association between enjoyment and intention to use smart products have been established in past investigations, so it would be important health ICTs to provide also recreational services to them to enhance their moods and enjoyment facilities, positive influencing the intention of using smart-homes and health technologies. **Affordability:** The price can negatively influence the use of Health ICTs by elderly citizens, as in many cases they have a limited pension. For this investment they need to have a perceived usefulness, understanding how this technology can have a positive contribution in their health and daily tasks management.

4. Elderly Health Management

Socio-economic development and medicine advance led to a longer life and subsequently to a demographic change. In developed countries, the Elderly population, characterized as the individuals aged 65 or over, is expanding in comparison to youth population. Japan elderly ratio is the most noteworthy globally, 25,06% in 2015, and Portugal is also among the most elevated. (OECD, 2017).

In 2015, the residents in Portugal with 65 years or more were around 2 million, representing 20,3% of the Population, positioning Portugal as the 4th European Country with the highest aging rate, 1,4% above the European average (European Commission, 2015).
From 1961 to 2015, the aging rate in Portugal raised from 27,5% to 143,9 (PORDATA, 2016), consequence of medicine progress combined with a low birth rate in Portugal, 1,3% children per woman, 3% lower than the European average and the second lowest in Europe[8]. (Eurostat Database, 2015).

[8] http://theportugalnews.com/news/portugal-reflects-global-decline-in-fertility-rates-with-one-of-lowest-birth-rates-in-world/47517

4.1. Elderly Health Issues

The ageing population leads to an intensification in the incidence of chronic diseases associated with the increased susceptibility among the elderly. Due to physical and mental consequences of aging, elderly population have a superior health vulnerability and social risk of loneliness and negligence (United Nations Economic Commission for Europe, 2013)[9]. It is important to provide the right environment for an "healthy aging", contributing for functional and mental capacity maintenance and healthy habits (World Health Organization, 2015).

Indicators show that ageing affects differently men and women, where women tend to live longer. In 2015, lifetime expectancy at birth for men was 77.4 years, while for women it was 83.2 years in Portugal (PORDATA, 2015)[10] that is according the European average between 28 countries, 77.8 years for men and 83.3 years for women. Man tend to rate their health better, 70%, then women, 65%.

Elderly population health is particularly susceptible, 23% of worldwide disease burden is associated to problems of people with 60 years or older. The common problems are associated to cardiovascular, respiratory, musculoskeletal and malignant neoplasm noncommunicable chronic diseases and mental disorders (World Health Organization, 2002)[11].

4.2. Challenge of Elderly Health Management in Portugal

Even life expectancy improved, the investment in the Portuguese public healthcare service is not enough to answer to the needs of the population (OECD/European Observatory on Health Systems and Policies, 2017). Because chronic diseases may span several decades, treatment patterns must also be modified from short-term to long-term management and treatments, necessitating a drastic transition in treatment methods.

The development of health management services involving ICTs will change the focus of medical services from hospital visits and treatments to managing the health decisions made by individuals in their daily lives[12]. In response to this challenge, a **national Portuguese strategy for active and healthy aging** aims to aware for the importance of active aging, as well as solidarity between generations. Exposed in first place of intervention is the health dimension focused in chronic diseases monitoring for more autonomy in daily tasks

[9] https://sustainabledevelopment.un.org/content/documents/1789hdr14-report-en-1.pdf
[10] https://www.pordata.pt/en/Portugal/Life+expectancy+at+birth+total+and+by+sex+(base+three+years+from+2001+onwards)-418
[11] https://www.who.int/mental_health/media/investing_mnh.pdf
[12] https://medium.com/@isegjbc/o-envelhecimento-da-popula%C3%A7%C3%A3o-portuguesa-8426628cf14c

management and minimizing physical and mental impacts. The general objective is to increase the healthy life expectancy at 65 years in 30%, this means providing the conditions for elderly people to live longer and healthier. [13]Promoting elderly social participation, education, security and safety of older people are also priorities for this strategy. It is aimed to invest in innovative projects and promote scientific active and healthy aging research to identifying the best practices.

5. Health ICTs Innovations

The healthcare sector is facing challenges due to population aging and financial crisis. The implementation of ICTs in health is contributing to answer to these challenges by reducing costs, increasing accessibility and improving overall medical service quality and well-being. Innovative medical services as telemedicine, home assistance and smart systems is enhancing healthcare cooperation and information sharing, bringing benefits not only to elderly patients but also friends, family, health professionals and institutions, making healthcare accessible to everyone-everywhere and reducing costs in hospital visits. Technology is transforming healthcare, moving from reactive to a proactive prevention of diseases and a more personalized assistance. (Aceto, Persico and Pescapé, 2018).

5.1. Health Communication Systems

The development of ICTs infrastructures permitted the wireless networks (wi-fi) and mobile communication with high performance (5G) to internet, improving communication that is essential in healthcare management and well-being. A higher connectivity facilitates information sharing and communication between health professionals and patients, mitigating location and time limitations[14]. For Doctors and unformal caregivers this tool also facilitates medical records sharing, facilitating information sharing and decision-making. (Aceto, G., Persico, V., Pescapé, A., 2018). Internet and mobile telephones are fundamental for elderly citizens to communicate with family and friends reducing risk of depression and also facilitate the access to health information for healthy and independent living (Vancea and Solé-Casals, 2016).

[13] https://www.sns.gov.pt/wp-content/uploads/2017/07/ENEAS.pdf
[14]https://pt.wikipedia.org/wiki/Tecnologias_da_informa%C3%A7%C3%A3o_e_comunica%C3%A7%C3%A3o

5.2. Telemedicine and Remote Monitoring of Vital Signs

Elderly people prefer staying in home instead of being institutionalized, living at higher privacy and comfort. Although, aging reduces physical often bringing chronic diseases as diabetes or arthritis, as well as psychological problems as depression or dementia, requiring proper healthcare assistance. Telemedicine urge as solution to help home assistance, mitigating costs, reducing hospitalization and improve the service, permitting degenerative and chronic diseases monitoring, facilitate routine tasks management of patients and caregivers, increase security and independency (Vancea and Solé-Casals, 2016).

The development of wireless sensing devices were fundamental, permitting real-time collection and storing of medical data, being a low-price, practical and non-invasive solution for measuring health parameters as blood pressure, oxygen saturation or heart rate Connected through wireless, this sensor provides information to medical systems, that can automate data analytics of big medical data thought artificial intelligence, providing critical insights for clinician's decision-making and ensuring an efficient information sharing, avoiding dangerous delays in response. Information systems can be programmed to help daily activities and alert in case of anomalies, positively contributing for prevention and long-term chronic diseases surveillance in home, as diabetes or cancer. Pre-programmed information systems can also be useful in reminding and tracking timing and quantity medication´ compliance. Aceto, Persico, and Pescapé, 2018).

5.3. Tele Emergency Assistance and Fall Detectors

Portuguese "Cruz Vermelha" developed a Teleassistance solution[15] for Elderly citizens, where by clicking a simple hardware button it permits alarms a contact center 24 hours per day, automatically contact authorities in emergency situations, as a solution to improve elderly security and isolation. Additionally, smart devices can detect falls, alarming family and emergency service. This is an important solution as elderly population is particularly vulnerable to falls due to mobility and balance problems and the consequence can be particularly dangerous as bones are less strong.

5.4. Mobile Healthcare Applications (mHealth Apps)

Smartphones and connectivity allowed the expansion of health applications (apps). The Portuguese Health System (SNS) already launched two public apps, MySNS[16] and

[15] https://www.cruzvermelha.pt/sa%C3%BAde/%C3%A2mbito-nacional/teleassist%C3%AAncia.html
[16] https://www.sns.gov.pt/2016/09/15/mysns-a-app-para-o-cidadao/

Doctoralia[17], facilitating finding a doctor, book an appointment, pay health services, receive medical invoices, records analysis and provide health information.

Even actual elderly citizens are not used to actively download and use applications. Although, this tool can bring benefits, helping health problems management as diabetes, cancer, heart monitoring, arthritis, rheumatism, cognitive training, asthma, allergy, anxiety, insomnia, dementia, communication disabilities or visual impairment or cognitive. This application can also help managing physical training, nutrition, medication, fallow doctors' instructions, book a medical appointment and find a doctor, self-diagnosis and online assistance, pain management and facilitate access to health digital services.

Medical information apps represent 24%, physical parameters monitoring 22%, tracking diseases 18%, educational and management apps 16% and 6% for diagnosis. (Vancea, M., & Solé, J., 2016) (see Appendix number 1, List of Health Applications)[18]. The success of this health applications will depend on the adequacy degree to elderly needs, being fundamental to adapt the features and design according feedback. Additionally, it is important that medical professional perceive this apps as useful, promoting among patients and helping in the designing process, and adverting elderly for its limits and risks. There is also tools that facilitate doctors' work, facilitating medical records sharing and analysis. (Vancea and Solé, 2016)

5.5. Cognitive Training and Dementia Treatment

According "Health at a Glance 2017"[19] report published by OCDE (2017), Portugal is the 4th OCDE country with more Dementia cases, including Alzheimer (19,9 cases for each thousand habitants). Cognitive problem, commonly in elderly citizens, represent a public health problem. Smart devices (tables, computes or others) enabled the use ICTs applications, web programs, cognitive games or digital interactive music, movies or pictures to preserve and stimulate elderly cognitive abilities and non-pharmacological dementia management, monitoring the cognitive developments over time with a personalized training[20]. This tool shows also to contribute to depression, nervousness and irritability reduction, result of aging. This tool should be individually adapted according the dementia degree, requiring the support of a personal assistant (Osvath, Kovacs, Boda-Jorg, Tenyi, Fekete and Voros, 2018).

For moderate cognitive dementia, ICTs show to be useful in reducing anxiety and depression symptoms, by providing personal physical and psychologic status as well as

[17] https://www.doctoralia.com.pt/
[18] Table 1 and 2 of the appendix 1, presenting examples of mHealth applications and respective links.
[19] https://www.health.gov.il/publicationsfiles/healthataglance2017.pdf
[20] https://www.gqportugal.pt/10-apps-exercitar-cerebro

facilitating daily life management by providing information as convenient route, traffic or weather. In cases of **Severe** cognitive dementia, as Alzheimer or Parkinson disease, can be used video neuro-cognitive training, sound-text-image recognition or even virtually reality to retard cognitive deterioration. In advanced stages, passive ICTs tools can be used such as dementia safe-home by using alarms, cameras and sensors for air temperature, smoke, doors opening, electricity and motion detection, reducing the consequences of dementia as falls and wandering away of home, using GPS trackers. Special attention should be provided to involve patients feedback to develop friendly tools.

5.6. Domotic and Smart Sensors (Smart Houses)

Frontoni, Pollini, Russo, Zingaretti and Cerri (2017) developed a project to create an automated domestic environment using domotic and smart sensors technologies, acting as a virtual caregiver to help elderly in daily tasks by using voice boot control and automatically detecting and alarm in case of problems in home. Domotic permits to create smart interactives homes, interacting with people using voice commands to execute tasks as turn off lights, close windows or control room temperature. Additionally, smart sensors can proactively detect emergencies and ensure safety. A smart sensor in the floor can detect an elderly fall or smoke in the house, automatically singing an emergency alarm.

5.7. Robotics

The implementation of robotics and teleguiding technologies is being used as an assistant in surgeries, increasing precision to nanometer scale without trembling human effect. Additionally, robotics in "Mobile nursing" can enhance caregiver's assistance quality in hospital and elderly´ home, under the telepresence of nurses.(Aceto, Persico and Pescapé, 2018).

6. Application Challenges of Health ICTs for Elderly

Fischer, David, Crotty, Dierks and Safran (2014) review of literature showed that elderly citizens approach to health ICTs has specific challenges requiring a personalized technology design and assistance. Above all it is necessary to change cultural mindsets of elderly people, educating about the ICTs benefits in healthcare management. The authors cited Blackford Middleton that indicated that IT adoption problems is 95% related to sociocultural issues and only 5% with technology issues. These challenges can be divided regarding elderly´ lack of technology trust (low perceived benefits value in healthcare and issues of trusting reliability of

online content), reduced familiarity with technology (low technical digital skills), discomfort in asking for assistance, concern of information privacy and technology design challenge. Each topic will be addressed bellow.

- **Skepticism in Trusting Technology:** Differences between generations reflects in technology natural acceptance. Elderly citizens are resistant in accepting the benefits of technology and its applicability in healthcare, as well as in the accuracy and reliability of health information available online. Actual elderly population are used to trust family doctors and human information, instead of internet. A research indicated that 46% of elderly population surveyed do not trust internet as a source of health information. It is also associated their vulnerability and fear of abuses and scams, including medical frauds. The use of technology is more dependent on ICTs trust and acceptance then digital abilities to use it. Changing mindsets is fundamental. Above all, it is important to educate regarding the benefits of technology in health, changing elderly´s perceived value and increasing motivation for learning and using ICTs. It is important that technology be designed according personal needs and user feedback. (Fischer, et al 2014).
- **Reduced Technology Familiarity:** According Vacek and Rybenská (2016) research, the most common problem of actual senior citizens in using ICTs is their reduced experience, digital skills and lack of confidence in ICTs benefits. It was identified that people with low educational level and economic situation have less technological knowledge. Even elderly citizens 'healthcare needs, they feel less interested in using this solution, as they are not familiar to technology and don´t understand its benefits, what limits the potential of this tools in healthcare. Using new tools can bring stress and anxiety to Elderly citizens. Lack of confidence has also been cited as a barrier in use of ICTs in healthcare management and its benefits outcomes. Educational Workshops can support elderly and families to learn how to use this technologies and benefit from specific program. Training is fundamental for computer literacy, reducing anxiety and promoting interest. The authors survey a group of senior citizens and concluded that individual lessons are generally more suitable for elderly then group classes, taking in consideration a large disparity in elderly abilities. The success of this workshops and quality of skills gained will depend on teachers' attitude, accessibility of the course, learning environment and compatibility of the learned system with the ones used in home.
- **Discomfort in asking for assistance:** Elderly citizens tend to have a low confidence in their digital abilities and blame their talent in case of usability problems. This makes them discomforted to ask for assistance and training. Additionally, cognition changes due aging

decreases their social abilities, naturally saving this difficulty for themselves. This is a problem, as it demotivates elderly and reduces positive implementation of technology in healthcare management and personal independency. Personal assistance is a solution and will become important in the future, where elderly can stablish a trust relationship and a more personalized service to understand feedback and problems. (Fischer, et al 2014).

- **Concerns in losing information security:** Privacy and Security is a primary concern for elderly citizens and this population have the perception that online information is not secure and have the fear to share personal information as address and health records, preferring human support rather technology use. Health Information systems must ensure that information can only be accessed by authorized users according patient consent. Cloud storing of information is a major concern, being necessary to adopt security algorithms encryption in data management systems to prevent hackers' attacks. This will permit elderly to feel that the risks are low (Aceto, Persico and Pescapé, 2018).
- **ICTs Design challenge, Personalization of technology:** This is the conclusion of 13 studies in patients over 65 years by the U.S. Agency for Healthcare Research and Quality in 2008, concluding that systems tend to be more effective when they provide and combine different functions as monitoring, personalized feedback, interpretation and communication to the patient with medical advices, with rapid response. Additionally, this tool must be easy to use and easily personalized/programmed to specific daily routine according each medical problem. In sensitive health conditions, anonymity can be important. (Fischer, et al 2014). Recent studies show that health technology apps fail because the navigation structure and search options is not adequately adapted. Take in consideration the feedback of users to design this apps is essential for delivering a good assistance and improve usability. (Jusoh, 2017)

Fischer, et al (2014) concluded that this system should be user-friendly, with a not complex and uniform interface, and reliable information management. The designing process needs to address physical disabilities, including tremor-stabilization or eyes mouse control with keyboard function or large images and fonts, and psychological impairments, using passive technology to guarantee elderly security (doors sensors or fall and GPS detectors). Training is fundamental for elderly citizens, family and health professionals to learn how to use this tool. (Fischer, et al, 2014).

The possibility of using of this technology should also be analyzed by medical professional, as there is the possibility of not being adequate, taking the limitations and social, emotional and environmental factors. In 2003 a study of elderly citizens with cognitive

disabilities found that 15% of this group did not use the devices because they were not able to use, not fitting their needs. The involvement of all healthcare stakeholders such as healthcare institutions, physicians, health care workers, individuals, and scientific researcher, software publishers, and public citizens is considered critical. (Fischer, et al, 2014).

7. Gamification for Elderly Use of Health ICTs

The analyses of the article "Gamification for Healthcare and Well-being" (Udara and De Alwis, 2019), permitted to validate that the application of gamified software solutions can be effective in health applications. All generations like to play games for enjoyment, that can be addictive. For the elderly population, the use of gamification can even be more useful, as they tend to be less active and caring less about healthy habits, spending the day watching television what can lead to cognitive decline and depression.

The interaction with gamification applications can stimulate different hormones in the brain that promote well-being sensations, very useful to treat depression and stress, as well as creating an immersive experience that engage the user for a continuous use of the platform, as a game-play, challenging users to accomplish objectives and change their habits.

8. Health ICTs Future Trends

The Global Agenda Council on Ageing of World Economic Forum in 2016 divided the elderly health technologies trends in 3 areas. **Social Connectivity and Emotional Health Technologies** ("Sense of purpose, meaning in life, emotional contact and overall mental well-being"). Emerging Trends: "Caregivers technologies may provide social engagement, employment or volunteer opportunities, or access to information and services.

Cognitive Technologies ("Mental well-being (anxiety, depression), alcohol intake, nutrition and medication adherence") Emerging Trends: "brain training applications have the potential to enhance cognition by improving memory, sustaining attention and facilitating dual-task performance. Cognitive assistive systems leverage advances in artificial intelligence and cognitive science to support independence among older adults". **Physical Technologies** ("Mobility, musculoskeletal disorders and mental well-being (dementia, cognitive decline"). Emerging Trends: "Technologies that encourage the measurement of regular balance and aerobic training promote physical ability in older life. As sensory capability declines, technologies that support maintaining sensory experiences can promote extended movement. Sensory technologies that support hearing, vision and tactile functions are growing in use in addition to those that detect and prevent falls using prosthetic devices and robotic assistants.

9. Literature Review Synthesis and Research Questions

The literature review provided an overview of importance of the Telecommunication corporate social responsibility and the role of ICTs in the Healthcare sector, being fundamental for improving communication and information sharing, enabling disruptive solutions as remote monitoring of vital signs and telemedicine assistance through distance, developing innovative solutions for elderly efficient healthcare management.

Although, it was possible to understand that the Elderly population face challenges for the use of ICTs, with a lack of familiarity of technologies or impairments that difficult a good use. The analyse of the Unified Theory of Acceptance and Use of Technology (UTAUT), Venkatesh, et al., (2003), provided valid information regarding what variables can influence the Use and Acceptance of ICTs, adapting this model to the elderly population and Health ICTs, by understanding the challenges of Elderly using ICTs, serving as the basis for the development of the a conceptual framework and two research questions:

- **Research Question 1:** "What variables influence Elderly Acceptance of Health ICTs?"
- **Research Question 2:** "What variables influence Elderly Use of Health ICTs?"

In the methodology chapter will be presented the conceptual framework pf this research.

Chapter IV - Conceptual Reference Framework

The designing of a conceptual reference framework serves as a guideline for the research by providing a schematic visual map of the research steps, presented in figure 4: **(Step 1)** Finding a theme to scope the research**,** in this case the implementation of Health ICTs for Elderly Healthcare Management; **(Step 2**) Understanding ICTs economic and social importance as well as the Acceptance and Use of ICTs; **(step 3**) Understanding Elderly Health Issues and the Public Healthcare situation in Portugal; **(step 4**) Understanding Health ICTs, including the existing innovation, the application challenges for elderly population, gamification and future trends.

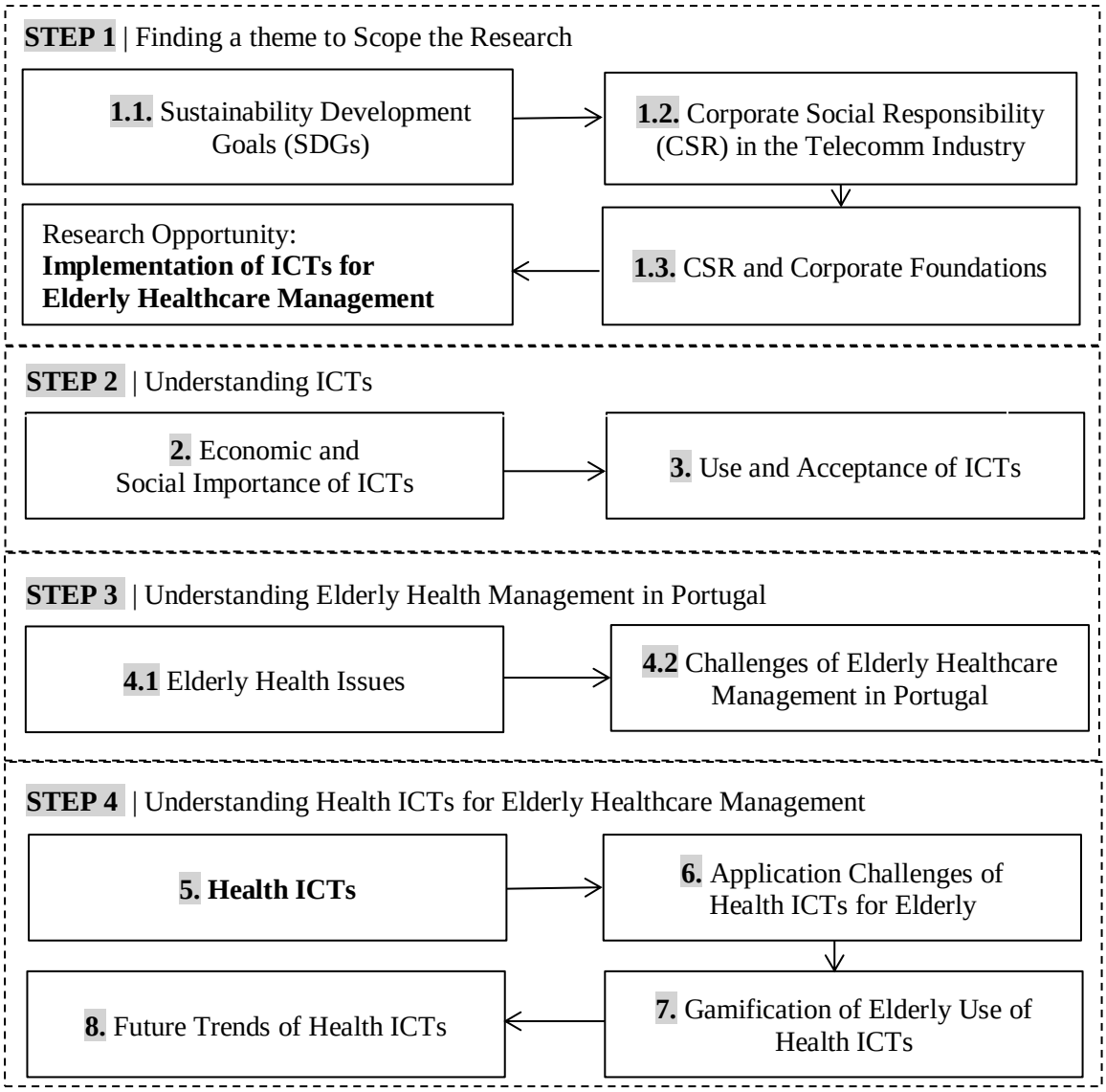


Figure 4 – Scheme of the Literature Review Process (Conceptual Reference Framework)

Chapter V – Methodology

This chapter presents the methodology fallowed during this in-company project, including the theme, research questions, hypothesis and conceptual framework development, based on a review of the existing literature. Additionally, to address the proposed research questions, this chapter explain the tools and research methods used to conduct a qualitative and quantitative analyze regarding Elderly´ Use and Acceptance of Health ICTs.

1. Research Approach: In-Company Project

My curiosity regarding Corporate Social Responsibility and Sustainability increased after the master´s elective course "Management Policies for Sustainability", taught by Professor Isabel Duarte de Almeida and actual Supervisor of my thesis research, challenging my critical thinking by analyzing real company case-studies of the best practices towards sustainable development. With the aim to pragmatically expand my knowledge in this field and solve a real company challenge, I decided to pursue this research as an In-Company Project. With the support of my supervisor, Professor Isabel Duarte de Almeida, it occurred the opportunity to collaborate with Altice Portugal, trough Professor Graça Rebocho, at that time Director of Altice Foundation and actual Director of Altice Human Resources.

To find the theme to scope the research the first step was to analyze the existing literature regarding CSR in the Telecommunication Industry and the most relevant CSR dimensions in this sector. The theoretical research includes analysis of published works such as academic thesis and scientific articles written by managers and researchers with experience on the field. This permitted to identify the best practices in term of Sustainability, particularly in the referred SDGs, pointing potential new practices for ALTICE and AlticeFoundation.

As result, it was identified the opportunity to explore the theme regarding Health ICTs for Elderly healthcare management in Portugal, as telemedicine or teleassistance, as an answer to the demographic changes and economical challenges of public healthcare service to reduce unnecessary hospitalization and hospital visits, that are a relevant part of public health expenses.

The theme received a positive approval when proposed in the first meeting in Altice Foundation with Professor Graça Rebocho (See Appendix number 4)[21]. This way, to start the project we visited Altice Labs in Aveiro in order to understand what Altice was developing in this field where Vitor Ribeiro, Team Leader at Altice "Portugal Telecom" Innovation,

[21] Appendix 4, presentation slides: 1º meeting with Altice Foundation (September 2019)

presented the strategy and characteristics of the platform that Altice is developing in the healthcare sector, the "SmartAI" platform. (See Appendix number 5).[22]

The **purpose of this research** is not to find a precise answer, but instead to provide valid recommendations by understanding elderly citizens´ acceptance and use of health ICTs, applying face-to-face questionnaires, visiting elderly care homes and senior universities. Additionally, interviews to health professionals, Francisco Frazão, Gonçalo Duarte and Miguel Fernandes, permitted to understand opinions regarding the benefits and obstacles of implementing ICTs in Elderly Healthcare management.

This research was based in UTAUT theorical model (Venkatesh et al.,2003), as will be explained. A new conceptual model will be presented in this chapter, schematizing the relationship between the variables that can influence health ICTs use and acceptance. It will be also justified the methodology used to answer to the research questions, including the research instruments, data collection and analyses process.

2. Research Paradigm, Questions and Hypothesis

The research process starts with the identification of a problem and research methods to find a valid answer (McDaniel e Gates, 2005). First, it was important to understand what is a paradigm "paradeigma" question. In 1962, Kuhn first introduced this term as a conceptual framework accepted by the research community that provides guideline to conduct a research. In this specific project, the Research Paradigm is to understand the Acceptance and Use of Health Information and Communication Technologies (ICTs) by the elderly population, empirically based on the **Unified Theory of Acceptance and Use of Technology – UTAUT (Venkatesh, et al., 2003)**, previously introduced in the Literature, Chapter 3.4.1. The constructs presented in original UTAUT theory were adapted, including information security and affordability. Two research questions were defined, distinguishing Use and Acceptance, presented in the next two pages.

Research Question 1:**What variables influence Elderly Acceptance of Health ICTs?**

Prq[23] (1) x/y/z/w/k- Research proposal: The X/Y/Z/W variables influence Elderly Acceptance of Health ICT;

[22] Appendix 4, Questions Guideline: Visit to Altice Labs (5 December)
[23] PRQ1: Proposition Research Question 1

X - Usefulness Expectancy. Hypothesis (H1): Usefulness Expectancy can positively influence Elderly Acceptance of Health ICTs.

Y – Effort Expectancy. Hypothesis (H2): Effort Expectancy can negatively influence Elderly Acceptance of Health ICTs.

Z – Social Influence. Hypothesis (H3): Social influence can positively influence Elderly Acceptance of Health ICTs.

W – Information Security and Privacy. Hypothesis (H4): Information Security and Privacy can negatively influence Elderly Acceptance of health ICTs.

RQ1 - What variables influence Elderly Acceptance of Health ICTs?			
Hypothesis	Relationship	Independent Variable	Moderator Variables
H1: Usefulness Expectancy can positively influence Elderly´ Acceptance of Health ICTs. Question: "It would be useful for me to use ICTs for managing my health"	Positive (+) Influence	X- Usefulness Expectancy	Gender and Age
H2: Effort Expectancy can negatively influence Elderly´ Acceptance of Health ICTs. Question: "It will be easy for me to use Health ICTs"	Negative (-) Influence	Y- Effort Expectancy	Gender, Age, Education Level, Profession and Experience using ICTs
H3: Social influence can positively influence Elderly´ Acceptance of Health ICTs. Question: "Important People for me support that I use Health ICTs"	Positive (+) Influence	Z- Social Influence	Gender, Age and Experience using ICTs
H4: Information Security and Privacy can negatively influence Elderly´ Acceptance of health ICTs. Question: "I believe that Health ICTs can guarantee Information Security and Privacy"	Negative (-) Influence	W - Information Security and Reliability	Age, Gender, Education Level and Experience using ICTs

Table 1 – RQ1: Acceptance of Health ICTs (Hypothesis and Moderator Variables)

Research Question 2: **What variables influence Elderly Use of Health ICTs?**

Prq (2)[24] a/b/c/d- Research proposal: The variables A/B/C/D can influence Elderly Use of Health ICT;

A – Health Benefit - Hypothesis (H6): Health Benefit can positively influence Use of Health ICTs.

B - Usability - Hypothesis (H7): Usability can positively influence Use of Health ICTs.

C – Access to Assistance - Hypothesis (H8): Access to Assistance can positively influence Use of Health ICTs

D – Access to Health ICTs - Hypothesis (H8): Affordability can negatively influence Elderly Use of Health ICTs.

RQ2 - What variables influence Elderly Use of Health ICTs?			
Propositions and Questions	Relationship	Independent Variable	Moderator Variables
H5: Health Benefit can positively influence Elderly´ Use of Health ICTs Question: "Health ICTs that I use have brought benefits to my health management"	Positive (+) Influence	A- Health Benefit	Age, Gender, Health Condition, Living With
H6: Usability can positively influence Elderly Use of Health ICTs Question: "Health ICTs that I use are intuitive and adapted to my capabilities"	Positive (+) Influence	B- Usability	Age, Gender, Education, Profession, Experience Using ICTs
H7: Access to Assistance can positively influence Elderly´ Use of Health ICTs Question: "I have access to assistance in case of difficulties using health technologies"	Positive (+) Influence	Z- Access to Assistance	Age, Gender, Living With
H8: Access to Health ICTs can negatively influence Elderly´ Use of Health ICTs Question: "I can have access to the necessary technologies for managing my health"	Negative (-) Influence	W - Affordability	Age, Gender, Education, Profession

Table 2 – RQ2: Use of Health ICTs (Hypothesis and Moderator Variables)

[24] PRQ2: Proposition Research Question 2

3. Conceptual Model: Elderly Use and Acceptance of Health ICTs

With the following conceptual model, it is possible to provide a visual structure of the variables/constructs influencing Acceptance (Research Question 1), presented in figure 5, and Use (Research Question 2) of Health ICTs, figure 6, identifying the relationships.

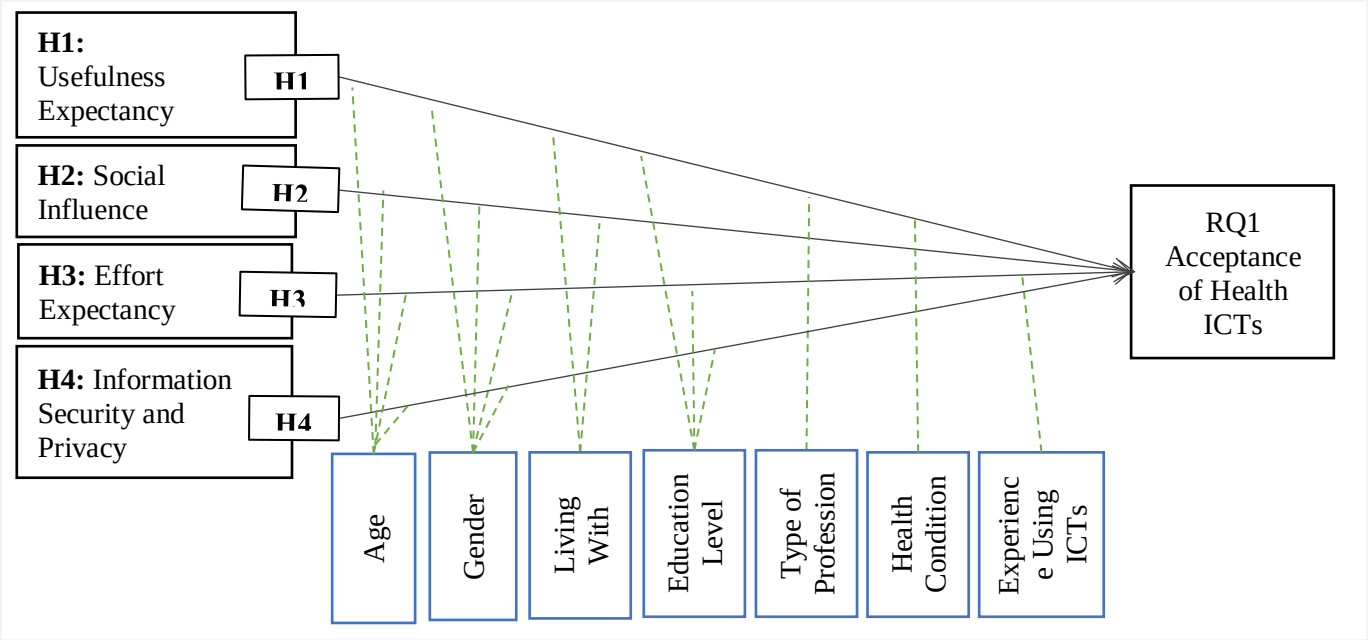


Figure 5 – Conceptual Framework: Research Question 1, Acceptance of Health ICTs

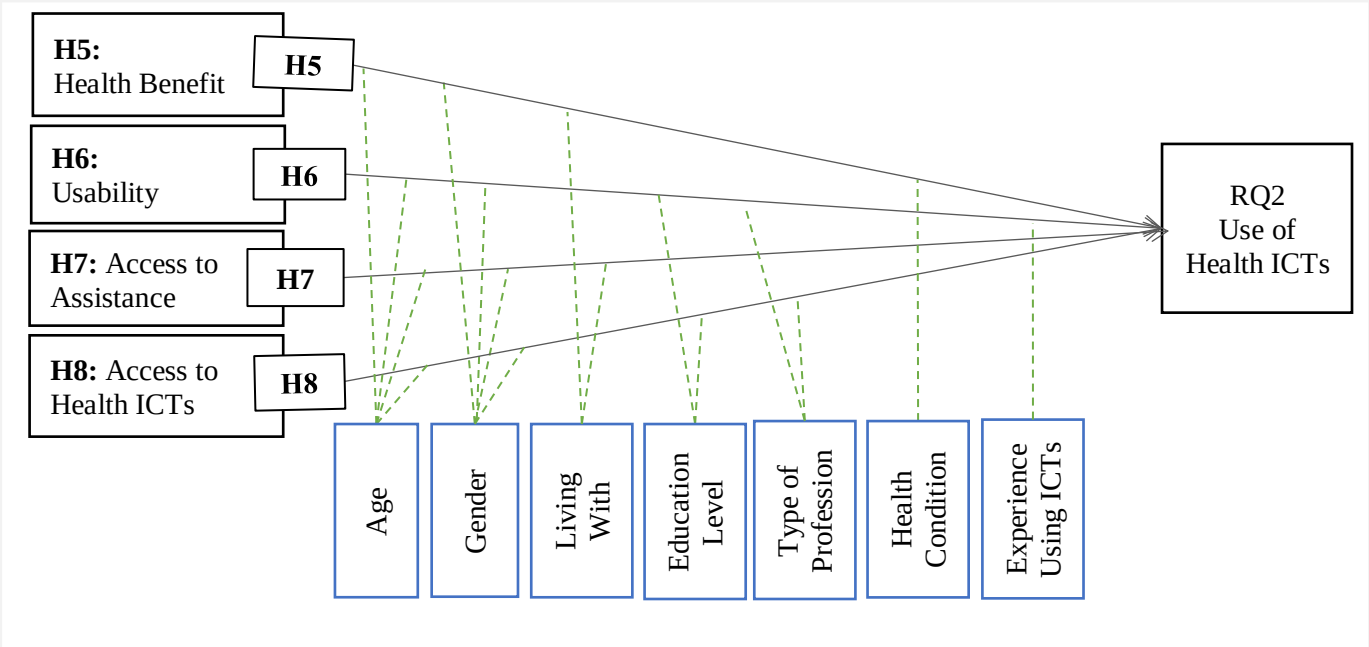


Figure 6 – Conceptual Framework: Research Question 2: Use of Health ICTs

4. Research Method and Data Collection

In order to test and validate the conceptual framework presented and answer to the proposed research questions it is essential to collect information, in this case directly from elderly citizens regarding their acceptance and use of Health ICTs. The population target of this research are the Portuguese senior citizens aged 60 years and over.

According to the purpose outlined for the present study, the population target of the research and the type of data that should be collected, it was decided to use a questionnaire as a suitable methodological research tool.

A face-to-face questionnaire is the more appropriated data collection tool, permitting to interview elderly that use or do not use technology (online surveys wouldn´t allow). This approach has the advantage to overtake barriers as concentration and hearing problems, adapting the voice tone and duration of the questionnaire according each participant, as well as stablish a personal conversation to understand behaviors and fears. This type of questionnaire also allows to perform street interviews, with a minimum duration of 7 minutes, but also in elderly homes and senior universities, having the advantage to stablish a conversation with the participant. Although, this method has disadvantages, including a higher investment in time to interview each person, limited sample size and need to enter data twice, registering the answers in paper and afterwards manually on the computer.

The face-to-face questionnaire was applied to a group of 142 participants. The data collection process took two months, from April to the end of May 2019, visiting four Senior Universities("Universidade Sénior Dom Sancho I", "Universidade Sénior da Moita", "Universidade Sénior da Amadora (CUTLA)" and "Universidade Sénior de Marvila") and three Elderly Residences ("Lar Estrelícia Rosa", "Lar Momentus Senior" and "Residência Senior DomusVida"). The strategy to diversify the sample, from seniors living in elderly residence typical older and with health support, with less need to use technologies by their own, to senior universities, where senior students tend to be more familiar and curious to use technologies, accepting more positively health ICTs, as well as active in society.

For the developments of the questionnaire a pre-test was performed to 10 people in the target population. The feedback collected permitted to readjust the structure and questions from an initial version had 27 questions to 15 more relevant, with a duration of 7 minutes.

The Questionnaire structure is divided in 3 groups, in a total of 16 questions. The first group, **Group A**, collects general personal information regarding the participant, including

gender, age, residence, education level, profession and occupation, in order to understand the sociodemographic profile of the participants.

Group B evaluate the experience of ICTs use, including general ICTs as landline phone, dump phone, smartphone, television, computer, internet or tablet as well as Health ICTs, asking in a Likert scale 1 to 5 the experience using Health ICTs and the degree that the participant agrees or not (1-totally disagree and 5-totally agree) with four affirmations regarding the variables in study that have a possible influence over use evaluation (Health Benefit, Usability, Access to Assistance and Affordability).

Group C is also subdivided in 2 parts, where the first one asks the participant to evaluate their health 1 (not healthy) to 5 (very healthy), and posteriorly evaluating the elderly acceptance of Health ICTs and variables that could influence (usefulness Expectancy, effort expectancy, social influence and information security and Privacy). To finish this group, there is two questions asking what TICs and Health Apps the participant would be interested to use in the future. The questionnaire used in this research is presented in Appendix.

5. Data Analysis Techniques

To start, the data generated from the 142 questionnaires answers were introduced manually in IBM SPSS Statistics, software used for qualitative analysis of responses. In a first stage a descriptive analysis of the sample was conducted in order to characterize the participants profiles (first group of the questionnaire) in terms of age, gender, residence, education level, occupation and type of professions, using tools as bar chat, pie chart or boxplot. This information is vital, in order to associate how the characteristics of the participant could influence Use and Acceptance of Health ICTs.

Afterwards, it was used crosstabulation tool to compare the different moderator variables, as age, gender or education level with the experience using ICTs as smartphone or computer, with the aim to evidence what type of profiles have higher familiarity with technologies. The same analysis was used to Health ICTs use and acceptance evaluation, crosstabulation also other factor, health evaluation, in order to understand if participants with less positive health evaluation would accept more positively health ICTs.

Before testing the hypothesis, it will be necessary to calculate the internal consistency of the sample, using alpha coefficient. Once confirmed the reliability and consistency of the use and acceptance evaluation model it will be possible to test the correlations between the dependent and independent variables, using Pearson correlation. According the correlation values it will be possible to test the validity of the proposed hypothesis, H1 to H8.

Chapter VI – Questionnaire Results Analysis

1. Sample Description

To initiate the analysis research of the results collected from the face-to-face questionnaire, descriptive statistics will be used to provide a descriptive of the sample regarding: (i) number of participants, location and partnerships, (ii) age, (iii) gender, (iv) Residence Location and living with who, (v) types of profession and (vi) education level.

(i) Number of Participants, location and Partnerships

Initially, the first interviews were conducted in street, collecting 51 answers. Afterwards, interviewed 35 participants in the visit to 4 senior universities, being an interesting partnership as elderly that frequent this universities are active and curious to use technologies. Additionally, for representing the reality it was also interviewed 16 elderly in 3 residences, 28 in hospital and clinics, 9 in domiciliary elderly service and 14 online interviewed (table 3). In total, 142 participants aged minimum 60 years old were interviewed.

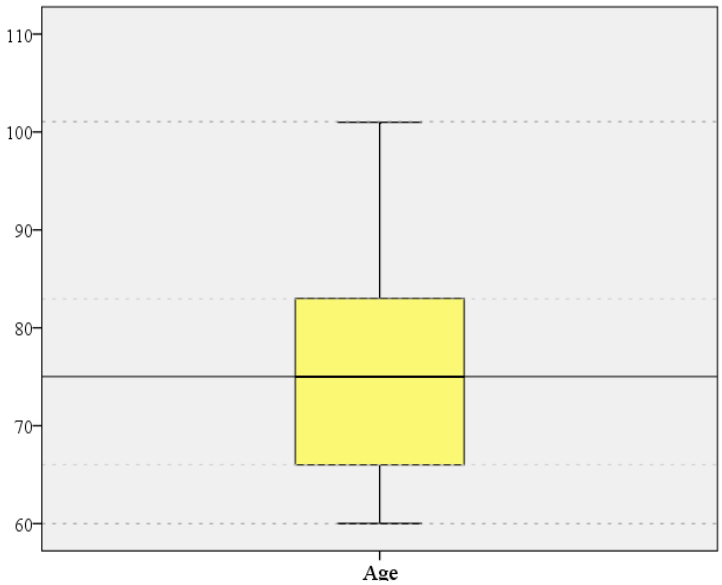
Senior Universities	Universidade Sénior Dom Sancho I	8
	Universidade Sénior Moita	6
	Universidade Sénior Amadora (CUTLA)	12
	Universidade Sénior Marvila	9
TOTAL		**35**
Elderly Residence	Lar Estrelícia Rosa	4
	Lar Momentus Senior	9
	Residência Senior DomusVida	3
TOTAL		**16**
Hospital and Clinics	Waiting Rooms – Hospital Santa Maria (Lisbon)	17
	Health Staff – Hospital Santa Maria (Lisbon)	3
	São João de Deus Clinic (Lisbon)	8
TOTAL		**28**
Domiciliary Elderly Support in Lisbon	**TOTAL**	**9**
Associação Nacional Aposentados da Polícia	**TOTAL**	**3**
Street Questionnaires in Lisbon	**TOTAL**	**51**
Questionnaires Total		**142**

Table 3 – Number of questionnaire Participants and where the answers were collected

(ii) Age

To facilitate the analysis, the age of the participants was clustered in 4 groups (60-70, 70-80, 80-90, More 90). The participant´s age average was 75 years old, with mode of 82 years old and the maximum age 101 years. Frequency and percentages are expressed in figure 7.

Age Range	Frequency	Percentage
60-70(included)	52	36.6%
70-80(included)	43	30.3%
80-90(included)	43	30.3%
More 90	4	2.8 %
Total	**142 participants**	**100%**

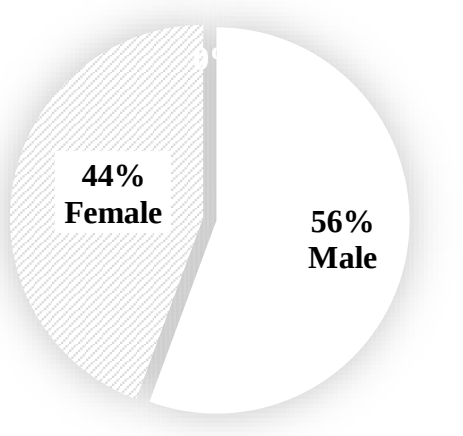


Mean	75.13
Median	75
Mode	82
Std Dev	9.56
Variance	91.422

Maximum	101 years
Minimum	60 years

Figure 7 – Sample Descriptive Statistics regarding Gender, including a boxplot graphic

(iii) Gender



It was pretended to have an equitable representative number of both genders, 79 women and 63 mans, representing 44,4% and 55,6% of the sample respectively, as represented in figure 8.

Figure 8 – Pie Chart: Percentage Participants Genders

(iv) Residence Location and Living with Who

Most of the sample are elderly residing in Lisbon (54.2%), including areas as Beato (14 subjects), Marvila (10), Campo de Ourique (9), Rato (8), Campo Grande (7), Penha de França (3), Estrela (2), Alfama (1), Olivais (1) and 22 not identified the specific Lisbon area.

Moreover, 30 residents from Setúbal were interviewed, with the aim to diversify the sample with elderly living outside Lisbon as Sesimbra (10), Almada (8), Costa da Caparica (7) or Moita (5). Additionally, 35 participants (15,7% of the sample) are residents in areas near Lisbon as Amadora(5), Cascais(8), Sintra(3). Eleven participants not identified their residence.

It was also possible to understand that 45% of the participants live with their partner, wife or husband (64 participants), 30.3% living alone (43 participants), 12.7% with family (18 subjects) and 11.9% in elderly homes (17 subjects)

(v) Type of Profession

In order to facilitate the analysis, the professions were grouped in different types, as presented in figure 9.

Three **Business owners** were interviewed and 13 female participants (9.15%) as **domestic**.

Health professions (15.5%, 22 participants): Nurses, doctors, pharmaceutical as well as health technical professionals.

Not Qualified jobs (21.13%, 30 participants): civil construction professionals, factory workers, security professions, cleaning maids, receptionist or store employee.

Professors and Intellectual Professions (7.75%, 11 participants): primary teacher, language teachers, University Professors and academics researchers.

Technical Jobs (51 participants, 35.9%): professional drivers, security guards, cookers, seamstress, insurance Professionals, gardener or mechanics technicians**.**

Qualified professions (22 participants, 15.5%): lawyers, engineers, managers and executive leaders, military and police officers.

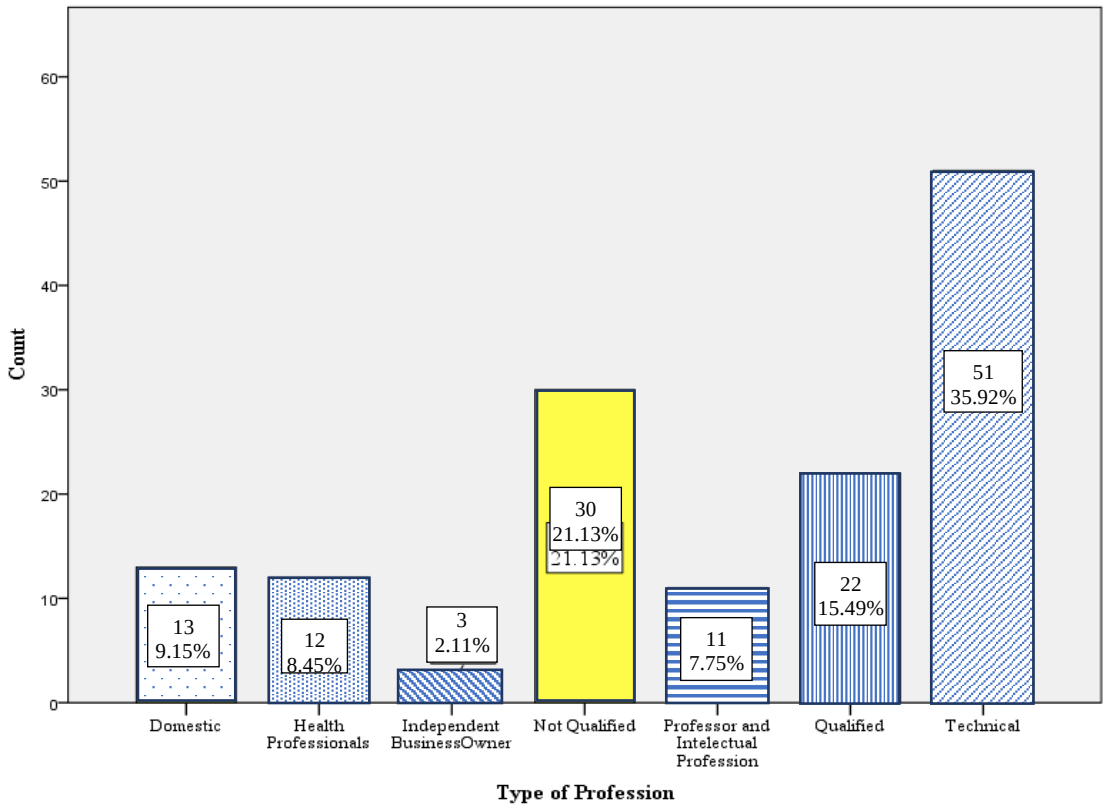


Figure 9 – Bar Chart: Types of Professions

(vi) Education Level

Regarding education level, 72 participants (50.7%) have basic education as primary school, 18 high school (12,7%), 23 frequented technical courses (23) and only 29 have academic background, more specific 16 bachelor (11,3%), 11 masters (11%) and 2 doctoral (1.4%).

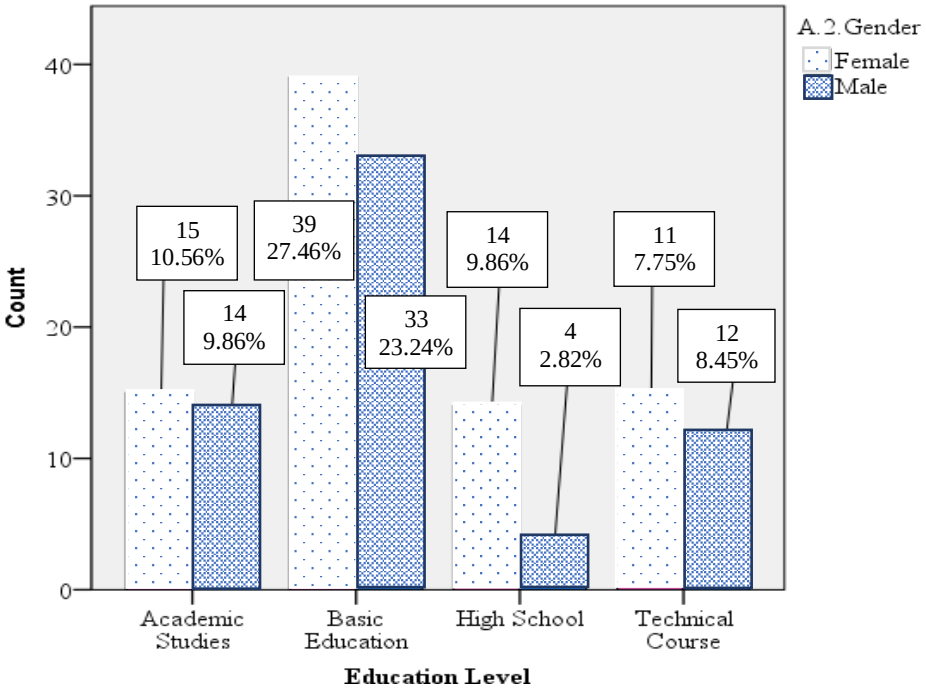


Figure 10 – Education Level (Bar Chart) according Gender

In figure 10 it is possible to visualize the distribution of education levels according gender, where there were more women with basic and high school. The gender difference regarding academic studies (bachelor, masters and doctoral) is not significant.

2. Use of ICTs

By asking the participants regarding their experience using Information and Communication Technologies, this including telephone, simple or smartphone, television, internet, computer or tablet it was possible to understand the different profiles and the influence regarding different factors as age, gender, residence, education level, occupation or profession.

ICTs Use	60-70 (included)	Over 70-80 (included)	Over 80-90 (included)	Over 90	Total
Don´t use ICTs	0	0	1	0	1
Use only 1 ICTs	1	0	6	2	9
Use 2 ICTs	1	6	18	2	27
Use 3 ICTs	6	16	13	0	35
Use 4 ICTs	7	2	1	0	10
Use 5 ICTs	18	11	3	0	32
Use 6 ICTs	19	8	1	0	28

Table 4 – Crosstabulation between Frequency of Use of ICTs and Age Range

In table 4 it is possible to analyses the relationship between age and experience using ICTs. The population aged between sixty to seventy, are more willed to use a differentiated number of ICTs tools, including tablet and other devices as computer and smartphone. Even less frequent, but there were a short number of participants (8) aged over 70 to 80 using Tablet, but in this group, it is more common the use of 5 or 3 ICTs, frequently smartphone and computer. Although, elderly aged over 80 years old also perceive ICTs useful in their life, using a minor number of devices to facilitate the communication and for entertainment, frequently watching television and using telephone or simple phone.

Regarding the influence of education level, table 5, with the familiarity of ICTs use, the answers analysis reveals that participants with academic studies, including bachelor, masters or doctoral, use a wider number of ICTs devices, possibly as ICTs were a tool used in their profession. In opposition, participants with basic education have a lower familiarity.

ICTs Use	Basic Education	High School	Technical Course	Academic Studies	Total
Don´t use ICTs	1	0	0	0	1
Use only 1 ICTs	8	1	0	0	9
Use 2 ICTs	18	3	4	2	27
Use 3 ICTs	23	3	7	2	35
Use 4 ICTs	5	2	2	1	10
Use 5 ICTs	10	4	4	14	32
Use 6 ICTs	**7**	5	6	10	28

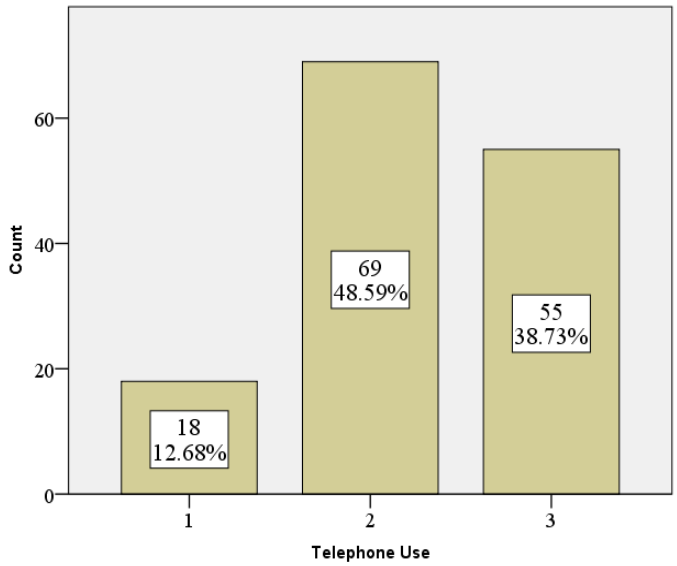
Table 5 – Crosstabulation between ICTs use and Education Level

Descriptive statistics including Histograms and crosstabulation tables were used to understand the frequency of use of TICs and the influence of variables as age, gender, place of residence, living with, education level or type of profession. Crosstabulation tables outputs are presented in appendices. The ones that are not relevant to make inferences are excluded.

In the next paragraphs, we will address the results obtained considering the questions about the use of (i) Landline Phone; (ii) Simple Telephone (Dump Phone); (iii) Smartphone, (iv) Television, (v) Computer and (vi) Tablet.

(i) Use of Landline Phone

Histogram Analysis (figure 11): it is possible to indicate that landline is used by elderly frequently everyday (48,59%, 69 subjects), but there is also a group that use landline with less frequency (38,73%, 55 subjects) and other that don´t use (12,68%, subjects).



1 - "Don´t Use Telephone"
2 – "Use Telephone Everyday"
3 – "Use Telephone, but not Everyday"

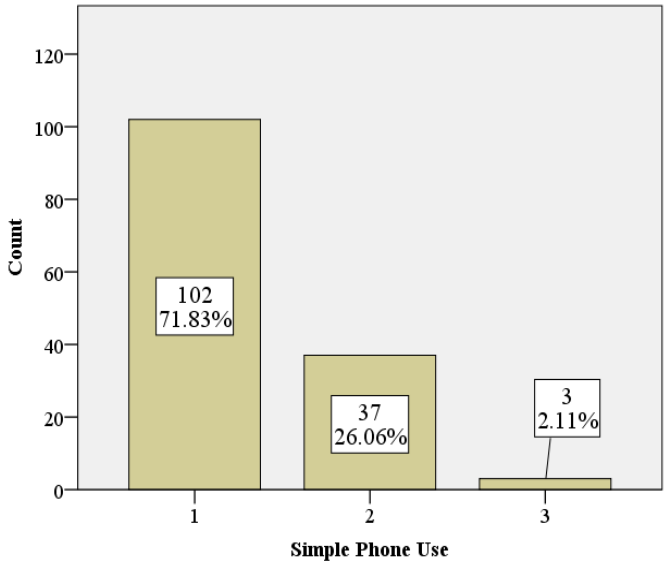
Figure 11 – Histogram Graphic: Frequency of Telephone Use

Histogram Analysis (figure 11): it is possible to indicate that landline is used by elderly frequently everyday (48,59%, 69 subjects), but there is also a group that use landline with less frequency (38,73%, 55 subjects) and other that don´t use (12,68%, subjects).

AGE: Regarding the influence of age over the use of landline, the group from 60 to 70 years old, included, is the one with higher number of subjects not using landline phone (10) or using it not every day (29), with only 13 subjects using every day. Subjects aged over 70 to 80, included, use more frequently landline phone, although subjects aged over 80, including the ones aged over 90, are the ones using landline phone more frequently. (Appendix Table 3) **GENDER:** not significant difference. **LIVING WITH**: Elderly living alone or in elderly homes use more frequently landline phone as the ones living with a partner tend to use less. (Appendix Table 4) **EDUCATION LEVEL:** Concerning education subjects with basic education tend to use with higher frequency landline everyday then the ones with academic studies. (Appendix Table 5)

(ii) Use of Simple Telephone (Dump Phone)

Histogram Analysis (figure 12): 71,83% of the elderly interviewed don´t use simple phone, using a smartphone. Although, 26% still using a simple mobile phone every day. Majorly elderly use phone every day, although there is a group of 3 participants using it not every day.



1 - “Don´t use dump phone”
2 – “Use dump phone every day”
3 – “Use dump phone, but not every day”

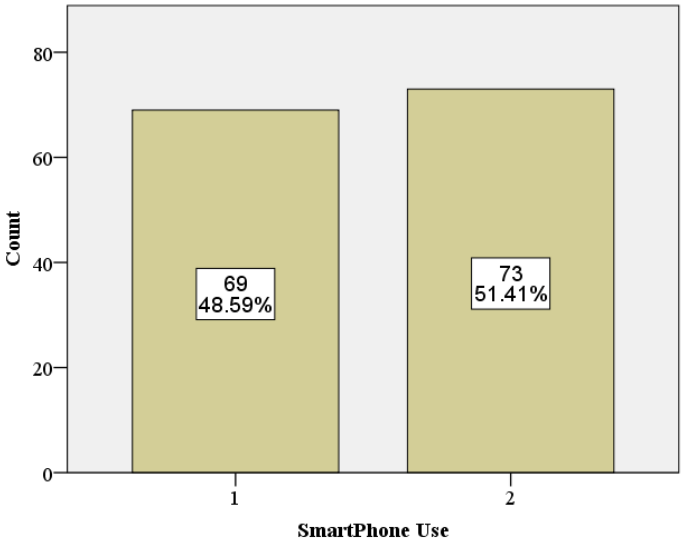
Figure 12 – Histogram: Frequency of Simple Phone Use

AGE: In terms of age range, the group that use telephone is the one aged over 80 to 90 years old. The younger elderly population aged from 60 to 70, included, tend to not use telephone. (Appendix Table 6). **GENDER:** The crosstabulation between gender and use of simple smartphone show us that there are more man using telephone then female. (Appendix Table 7)

RESIDENCE: there are more Elderly from Lisbon use simple phone (Appendix Table 8) **LIVING WITH:** Elderly living in elderly homes or with family tend to not use smartphone. (Appendix Table 9) **EDUCATION:** Participants with basic education and not qualified professions are the ones that use dump phones. (Appendix Table 10) **OCCUPATION:** retired elderly are the ones using simple telephone. (Appendix Table 12)

(iii) Use of Smartphone

Histogram Analysis (figure 13): Only half of the people interviewed use smartphone, 51,41%, and the ones that use it, use frequently every day (graphic 3).



1 - "Don´t Use smartphone"
2 – "Use Telephone Everyday"
3 – "Use Telephone, but not Every day"

Figure 13 – Histogram: Frequency of Smart Phone Use

AGE: The use of smartphone is more common among younger elderly, especially in ages between 60 to 70, included, where 88,5% use smartphone. (Appendix Table 13)

GENDER: The use of smartphone is more frequent in women then mans, 63,3% percent of the women use and man only 36%. (Appendix Table 14)

LIVING WITH: The use of smartphone is more frequent in elderly living with a partner or family, 59,4% and 61% respectively, then who lives alone or in elderly homes. We could eventually explain this as elderly living with a partner or family have higher social incentive to start using technology and support in case of problems. Additionally, subjects who live alone or in elderly home are older. (Appendix Table15).

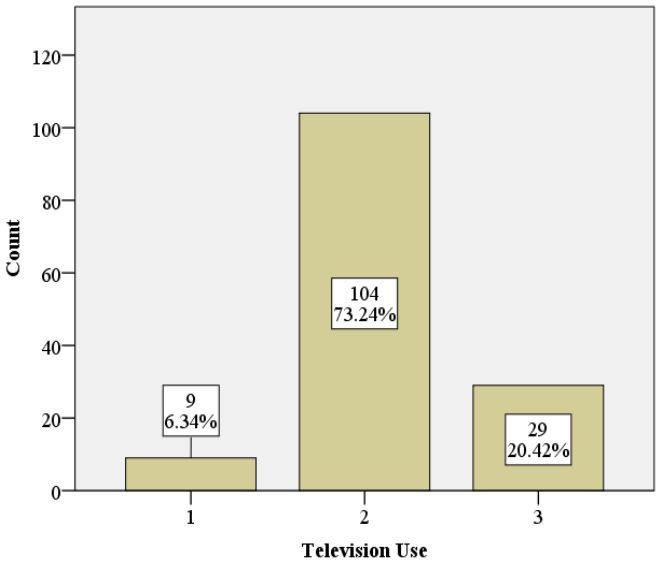
EDUCATION: Regarding the influence of the education level, the group of elderly with basic education is the one with less people using smartphone. Only 36,1% of the elderly with basic education use smartphone, in opposition to 75,8% of elderly with academic level. (Appendix Table 16)

PROFESSION: It was possible to indicate that health professionals is the group that use smartphone more frequently, 75%. (Appendix Table 17)

In summary, it is possible to evidence that younger elderly (aged 60-70, included), female gender, living with family or a partner and with academic education level are the ones that tend to use smartphone.

(iv) Use of Television

Histogram Analysis (figure 14): By analyzing graphic 4, it suggest that the use of television among Elderly is important as 92,66% of the people interviews watch television, 73,24% every day and 20,42% not every day.



1 - "Don´t Use Telephone"
2 – "Use Telephone Everyday"
3 – "Use Telephone, but not Every day"

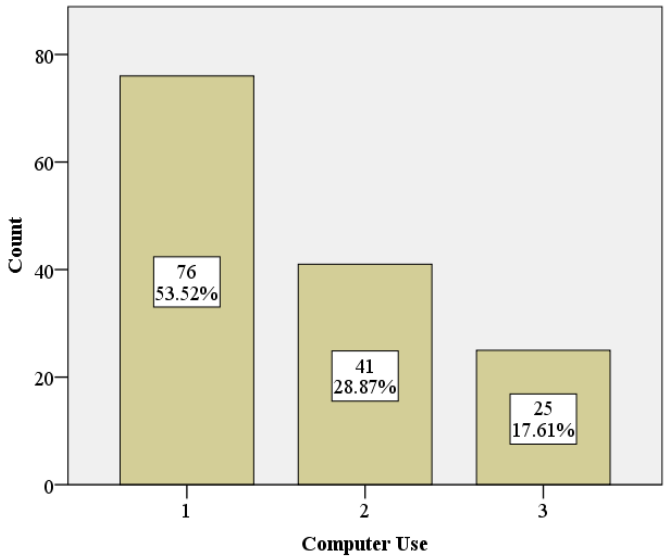
Figure 14 – Histogram Graphic: Frequency of Television Use

AGE: the group aged between 60 to 70 is the one with more participants (16) use smartphone but not every day. Elderly aged above 80 watch television every day. (Appendix Table 18)
GENDER: It was not possible to indicate that women watch television more frequently then mans, in fact there were more women saying they watch television, but not every day (20 subjects). We can associate this result as there were more younger women being interviewed, group that watch television less regularly. (Appendix Table 19).
RESIDENCE: There were a higher percentage of elderly living in Lisbon watching television then in Setúbal, 77,9% and 60%. (Appendix Table 20)
LIVING WITH: Elderly living alone or in Elderly homes watch television more frequently. (Appendix Table 21). **OCCCUPATION:** Retired elderly watch television every day, more frequently than the ones that still active (Appendix Table 22).

In conclusion, elderly aged above 80, retired, living in Lisbon alone or in elderly homes watch television every day.

(v) Use of Computer

Histogram Analysis (figure 15): According the presented histogram, graphic 5, elderly have a low familiarity using computer, 53,52% never used computer. Although, there is a group of 46,5% that already use computer, 28,8% every day and 17,6% with less frequency.



1 - "Don´t Use Telephone"
2 – "Use Telephone Everyday"
3 – "Use Telephone, but not Every day"

Figure 15 – Histogram Graphic: Frequency of Computer Use

Histogram Analysis (figure 15): According the presented histogram, graphic 5, elderly have a low familiarity using computer, 53,52% never used computer. Although, there is a group of 46,5% that already use computer, 28,8% every day and 17,6% with less frequency.

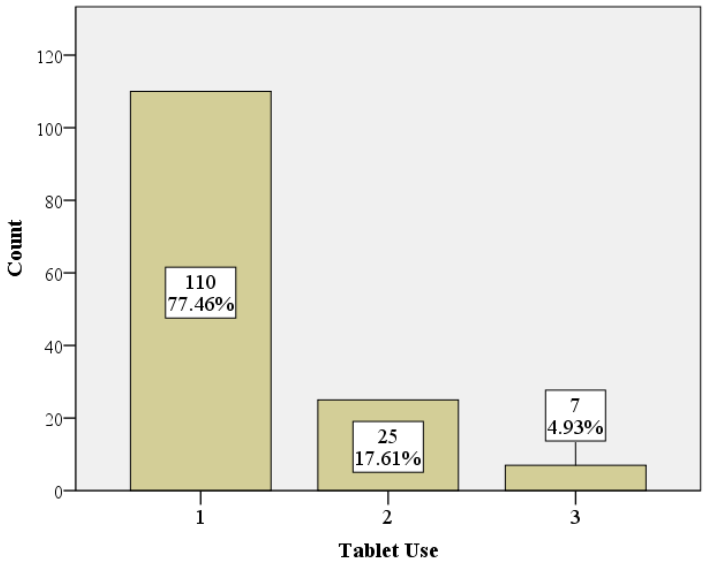
AGE RANGE: The use of computer is more common in younger elder aged between 60 and 70 (51,9% using every day) and 70 to 80, nevertheless, but only 30,2%. (Appendix Table 23). **GENDER:** Even the gender difference is not significant, there is a higher percentage of female using computer, as 60% of mans don´t use computer and 47% of women. (Appendix Table 24). **RESIDENCE**: According the sample, there were more people in Setúbal using computer then in Lisbon, 46% to 10,4%, but this can be explained as in Setúbal I visited senior universities, specifically in Moita and Almada, and in Lisbon elderly homes. (Appendix Table 25). **LIVING WITH:** The percentage of Elderly living with a partner or family using computer , 40% and 38% using every day, is higher than living alone or elderly homes,16,3% and 17,6%. (Appendix Table 26). **EDUCATION:** There is a significant percentage difference basic education, 11,11% using computer every day, and academic education level, 58,6% using every day). (Appendix Table 27). **PROFESSION:** Qualified Professionals use more computer then

not qualified, 41% and 20%.(Appendix Table 28) **OCCUPATION:** Senior citizens that still employed or independent business owners tend to use computer, and only 26% of the retired use computer every day. (Appendix Table 29)

The analysis permitted to understand that the ideal senior computer users' profile is aged between 60 to 70 years old, female gender, student in a senior university, living with family or a partner, academic background, employed, qualified professional or independent business owner

(vi) Use of Tablet

Histogram Analysis (figure 16): It is possible to visualize that only 32 in 142 subjects use Tablet, majorly every day. Tablet users are less frequent then computer, graphic 5, but the profile is identical.



1 - "Don´t Use Telephone"
2 – "Use Telephone Everyday"
3 – "Use Telephone, but not Every day"

Figure 16 – Histogram Graphic: Frequency of Tablet Use

AGE: Aged between 60 and 70, and a fewer percentage of users between 70 to 80 then computer users, only 11,6% using every day. (Appendix Table 30).

GENDER: Significant difference in term of age, as 27,8% of female gender use tablet every day and only 6% of mans. (Appendix Table 31). **RESIDENCE:** Not significant difference. (Appendix Table 32). **LIVING WITH:** Elderly living with a partner or family are more willed to use Tablet. (Appendix Table 33) **EDUCATION:** Participants with academic education, high school or technical courses, 38%, 22% and 26% using every day, respectively tend to use more computer then basic education, 7%. (Appendix Table 34) **PROFESSION:** Professors and Intellectual (33%), Qualified professions (23%) and domestic (31%, female gender), represent the group that use more tablet. (Appendix Table 35) **OCCUPATION:** 88,7% of the sample represent retired elderly, with the same percentage of tablet users as employed participants,

18%, demonstrating that employed elderly tend are more familiar with tablet user, as well as independent worker. (Appendix Table 36)

Elderly tablet ‘users are majorly aged between 60 and 70 years, living with a partner or family, with academic, high school or technical background, employed or business owners.

3. Users Profiles: Experience Using ICTs

The analyze of the experience of the elderly interviewed using ICTs, as landline phone, simple or smartphone, television, computer or tablet permitted to group the participants in 3 profiles of users (Profiles A, B and C) and 4 levels of experience using ICTs (Levels 0,1,2,3).

This groups are a generalization of the relationship between the participants characteristics and the experience using ICTs, summarizing the results presented regarding the Use of ICTs, although exceptions cases were identified of participants with not qualified professions or academic background, using tablet or computer.

Profile A:

- Don´t use any ICT **(Level 0, not using)** or use only simple ICTs as telephone, television of phone without access to internet **(Level 1, Basic User).**
- Aged above 80 years old in some cases this elderly had qualified profession and academic education level, although didn´t had the opportunity to learn and train the use of technology as computer. Or aged above 70 years old, with basic education level and not qualified jobs.

Profile B:

- Use smartphone or/and computer, but not Tablet **(Level 2, Intermediate User).**
- This group of user’s profiles are generally aged between 60 to 70 years old, in some cases with academic education level, qualified or technical professions. Include Senior University Students

Profile C:

- Use Tablet, smartphone and computer **(Level 3, Advanced User)**
- Alike profile B, aged between 60 to 70 years old, but with higher familiarity using ICTs. In general, with academic education level, that still active in work with qualified or intellectual professions as professors or academic researchers. Normally advanced users do not frequent senior universities, at least the informatic classes.

4. Use of Health ICTs

By Elderly tablet ‘users are majorly aged between 60 and 70 years, living with a partner or family, with academic, high school or technical background, employed or business owners. In a total of 108 participants, 56 never used ICTs related to health management, representing

almost 52% of the sample. Between the 52 participants that use Health ICTs, 34 used only one type of Health ICTs, 16 used two types of Health ICTs and two participants used 3 types of Health ICTs, as demonstrated in table 6.

Use of Health ICTs Use		
	Frequency	Percentage
"**Never Used** Health ICTs"	56	51,8 %
"Used only 1 Health ICTs"	34	31,5 %
"Used 2 Health ICTs"	16	14,8 %
"Used 3 Health ICTs"	2	1,8%
TOTAL	108	100%

Table 6 – Descriptive Statistics: Use of Health ICTs

According table 7, The Health ICTs more used between the elderly interviewed were Saúde 24 (29 users), health apps (28 users) and Health websites and internet research (24 users). Only can find 9 users of Health Monitoring systems and 8 users of health Emergency alarms, understanding the use of this Health ICTs is not frequent.

Elderly use of Health ICTs		
	Frequency Elderly Using	Percentage
1.Health Teleassistance (Saúde24)	29	20,4%
2.Health Apps	28	19,7%
3.Health Websites and Internet Research	24	16,9%
4. Health Monitoring System	9	6,3%
5.Health Emergency Alarm	8	5,6%

Table 7 – Descriptive Statistics: Use of each Health ICTs

In the next paragraphs, we will address the results of the questionnaire when asking the participants about the use of Health ICTs as (i)Health Teleassistance ICTs (Saúde 24), (ii)Health Apps; (iii)Health Websites and Internet Research; (iv)Health Remote Monitoring Systems and (v)Health Tele emergency alarm (Cruz Vermelha Emergency Bottom).

(i) Use of Health Teleassistance ICTS (Saúde24)

The analyses of table 8 permit to understand the profile of users using Saúde 24, a health teleassistance ICT solution, being possible to indicate it is more significantly common between elderly aged between 60 to 70, included (82,2% of the users) and female gender (70%) and retired (97%). Even the number of subjects interviewed in Lisbon is higher, there are more users in Lisbon then other locations, including Setúbal. We can assume that people in Lisbon are better informed regarding this health services and feel more willed to use Saúde24.

As Saúde24 is a simple system that can be used by elderly only by using a telephone, not needing informatic knowledge, this can be used by participants with basic education level, 38% of people using, followed by technical course, 24,1%.

		Frequency Elderly Using	***Percent (Within %)***
Gender	Female	20	69%
	Male	9	31%
Age Range	60-70 (included)	25	82,2%
	70-80 (included)	4	13,8%
Residence	Lisboa	15	51,7%
	Other	8	22,9%
	Setubal	6	20,7%
Living With	Partner	17	58.6%
	Alone	6	20.7%
	Family	5	17.2%
	Elderly Homes	1	3.4%
Education Level	Basic Education	11	37,9%
	Technical Course	7	24.1%
	Academic	6	20.7%
	High School	5	17.2%
Type of Profession	Technical	9	31%
	Not Qualified	5	17,2%
	Qualified	5	17,2%
	Domestic	4	13,8%
	Health Professionals	4	13,8%
	Professor	2	6,9%
Occupation	Retired	28	96,6%
	Employed	1	3,4%
Health Condition	4	14	48,3%
	3	12	41,1%
	2	3	10,3%
User Profile	Level 2 (Intermediate)	18	62.1%

	Level 3 (Advanced)	10	34.5%
	Level 1 (Basic)	1	3.4%
Reasons for not using	d) Didn´t know about this Health ICTs	35	31.0%
	a) Not familiar and not interested in using health technology	32	28.3%

Table 8 – Descriptive Statistics: Use of Health Teleassistance (Saúde 24)

Health Teleassistance solutions are more appropriated for prevention and management of not serious health problems, as 48,3% and 41% of the subjects using Saúde24 evaluate their health as good, between 3 and 4 (1 to 5). Regarding the reasons for not using this Health ICT, 31% affirmed they didn´t know about it and 28,3% are not familiar using health technology.

(ii) Use of Health Apps

According the analyses of table 9, the use of Health apps (applications) is more used by in younger Elderly, that already use mobile phone and tablet, 64,3% and among the 70-80, but only 35,7%. Additionally, as Saúde24, the use of health apps in more common in female gender, 71,4%.

		Frequency Elderly Using	***Percent (Within %)***
Gender	Female	20	71.4%
	Male	8	28.6%
Age Range	60-70 (included)	18	64.3%
	70-80 (included)	10	35.7%
Residence	Lisboa	14	50.0%
	Setubal	8	28.6%
	Other	6	21.4%
Living With	Alone	14	50.0%
	Elderly Homes	7	25.0%
	Family	6	21.4%
	Partner	1	3.6%
Education Level	Academic	12	42.9%
	Basic Education	8	28.6%
	Technical Course	6	21.4%
	High School	2	7.1%
Type of Profession	Not Qualified	6	21.4%
	Qualified	6	21.4%
	Domestic	5	17.9%
	Health Professionals	5	17.9%
	Professor	3	10.7%

	Technical	2	7.1%
Occupation	Retired	21	75%
	Employed	4	14,3%
	Business Owner	3	10,7%
Health Condition	4	14	50%
	3	11	39,3%
	2	3	10,7%
User Profile	Level 3 (Advanced)	16	51.6%
	Level 2 (Intermediate)	12	22.6%
Reasons for not using	a) Not familiar and not interested in using technology	35	30.7%
	d) Didn´t know about this Health ICTs	32	28.1%
	b) Not a health need (Good Health)	18	15.8%

Table 9 – Descriptive Statistics: Use of Health Apps

As the use of health apps required digital skills, associated to advanced level of users (51,6%), elderly with academic background, 43%, use more this service. Additionally, there are more users with qualified professions using then technical ones.

Health apps are used by elderly with good health condition. The reasons mentioned for not using health apps are lack of familiarity and interest using technology (30,7%), didn´t know about this service (28,1%) and not health need for start using (15,8%).

(iii) Use of Health Websites and Internet Research

As presented in table 10, elderly that use websites and internet to research regarding their health management are generally aged between 60-70 (70,8%) and 70-80 years old (29,2%), female gender (83,3%) with advanced or intermediate technology user profile (45,8% and 37,5%), academic background (33,3%), not qualified or technical profession (29,2% and 25,5%). Additionally, 83,3% of users are retired, living with a partner (50%) and resident in Lisbon (45,8%).

		Frequency Elderly Using	***Percent (Within %)***
Gender	Female	20	83,3%
	Male	4	16,7%
Age Range	60-70 (included)	17	70,8%
	70-80 (included)	7	29,2%
Residence	Lisboa	11	45,8%
	Setubal	7	29,2%
	Other	6	25,0%
	Partner	12	50%

Living With	Alone	8	33,3%
	Family	4	16,7%
Education Level	Academic	8	33,3%
	High School	6	25%
	Basic Education	6	25%
	Technical Course	4	16,7%
	Academic	8	33,3%
Type of Profession	Not Qualified	7	29.2%
	Technical	6	25.0%
	Domestic	4	16.7%
	Health Professionals	4	16.7%
	Qualified	2	8.3%
	Professor	1	4.2%
Occupation	Retired	20	83,3%
	Employed	3	12,5%
	Business Owner	1	4,2%
Health Condition	4	11	45,8%
	3	9	37,5%
	2	4	16,7%
User Profile	Level 3 (Advanced)	13	54.2%
	Level 2 (Intermediate)	11	45.8%
Reasons for not using	a) Not familiar and not interested in using technology	35	29.7%
	d) Didn´t know about this Health ICTs	30	25.4%
	b) Not a health need (Good Health)	23	19.5%

Table 10 – Descriptive Statistics: Use of Health Websites and Internet Research

Elderly that use internet for health research have a good health condition, evaluated 4 or 3 points in 10 (45,8% and 37,5%). Those who do not use this tool for manage their health refer barriers regarding familiarity and interest using technology (29,7%) or they didn´t know (25,4%) and not health needs to justify the use of this tools (19,5%).

(iv) Use of Health Remote Monitoring Systems

In a total of 142 people interviewed only 9 use a remote monitoring system (6,3%), as presented in table 11, collected in the domiciliary assistance service and elderly homes, as they have health conditions that require health assistance and control of vital signs. We conclude it's a

specific group with specific health need that justify the use of this technology for health monitoring or prevention, 77,8% evaluating their health as not good (Linkert Scale, 1-5, where 1 is a bad health condition and 5 a good health condition).

		Frequency Elderly Using	***Percent (Within %)***
Gender	Female	4	44.4%
	Male	5	55.6%
Age Range	70-80 (included)	4	44.4%
	80-90 (included)	5	55.6%
Residence	Lisboa	7	77.8%
	Other	2	22.2%
Living With	Partner	4	44.4%
	Family	2	22.2%
	Alone	2	22.2%
	Elderly Homes	1	11.1%
Education Level	Basic Education	5	55.6%
	Academic	2	22.2%
	Technical Course	2	22.2%
Type of Profession	Not Qualified	4	44.4%
	Technical	2	22.2%
	Qualified	1	11.1%
	Professor	1	11.1%
	Domestic	1	11.1%
Occupation	Retired	7	77.8%
	Employed	2	22.2%
Health Condition	2	7	77.8%
	3	1	11.1%
	4	1	11.1%
User Profile	Level 1 (Basic)	4	44.4%
	Level 2 (Intermediate)	4	44.4%
	Level 3 (Advanced)	1	11.1%
Reasons for not using	d) Didn´t know about this Health ICTs	38	28.6%
	a) Not familiar and not interested in using technology	33	24.8%
	b) Not a health need (Good Health)	27	20.3%

Table 11 – Descriptive Statistics: Use of Health Remote Monitoring Systems

In terms age range of users, 70-80 (44,4%) and 80-90 (55,6%) of subjects using. 77,8% of users are resident in Lisboa, 44,4% living with a partner, 55,6% with basic education level, 44,4% not qualified profession, 77,8% retired. The difference in genders is less significant than other ICTs that were more female using. Although, we could associate that Mans tend to

use this technology early has their life expectancy is lower, so they may have health conditions in 70-80 years old that need. In opposition to other advanced health ICTs as tele alarm, health apps or online websites, remote monitoring system, even complex, they are adapted for basic digital users (44,4% of the users) that need this solution to manage their health conditions.

(v) Use of Health Tele emergency Alarm (Cruz Vermelha)

Regarding the use of emergency alarm, it was registered 8 subjects among which 5 are women (62,5%), 6 aged between 70 and 80 included (75%), mostly living alone (75%), as presented in table 12.

		Frequency Elderly Using	***Percent (Within %)***
Gender	Female	5	62.5%
	Male	3	37.5%
Age Range	70-80 (included)	6	75.0%
	80-90 (included)	1	12.5%
	60-70 (included)	1	12.5%
Residence	Other	4	50.0%
	Setubal	2	25.0%
	Lisboa	2	25.0%
Living With	Alone	6	75.0%
	Elderly Homes	1	12.5%
	Partner	1	12.5%
Education Level	Academic	3	37.5%
	Basic Education	3	37.5%
	Technical Course	1	12.5%
	High School	1	12.5%
Type of Profession	Not Qualified	5	62.5%
	Technical	3	37.5%
Occupation	Retired	7	87.5%
	Employed	1	12.5%
Health Condition	2	5	62.5%
	3	2	25.0%
	4	1	12.5%
User Profile	Level 2 (Intermediate)	5	62.5%
	Level 3 (Advanced)	2	25.0%
	Level 1 (Basic)	1	12.5%
	d) Didn´t know about this Health ICTs	37	27.6%

Reasons for not using Telemergency Alarm	a) Not familiar and not interested in using technology	34	25.4%
	b) Not a health need (Good Health)	28	20.9%

Table 12 – Descriptive Statistics: Use of Health Emergency Alarm

In terms of education level 37,5% of subjects have academic background and the same percentage basic education. In terms of profession, 88% of the same is retired and in general had not qualified professions (62,5%). It is possible to understand that the use of a health emergency alarm don´t require advanced technology skills, where 62,5% and 12,5% have intermediate and basic digital skills.

The use of an emergency alarm is particularly useful for elderly with health needs, being a solution to communicate in case of health problems, falls and accidents. 5 users, representing 62,5% of users, evaluate their health in 2 points out of 10, representing a not good health condition. Suchlike other ICTs, 27,6% of not actual users said that the reason for not using an emergency alarm is that they didn´t know about the existence of this solutions.

5. Reasons for not Using of Health ICTs

Concerning the reasons for not using health ICTs, presented in table 13, in general, the most representative answer representing 26,1%, 37 in 142, was referred as obstacles regarding lack of familiarity and interest in using technology. Even health ICTs are perceived as useful, today´s elderly generation face challenges for adopting this solution as it requires a process of learning how to use technology what is not simple for someone aged and that never used it during all life, even causing stress and aversion.

Reasons for not Using Health ICTs	Frequency	Percent
Not familiar and not interested in using technology	37	26,1 %
Not a health need (Good Health)	28	19.7 %
Cognitive or Physic Impairment	4	2.8 %
Didn´t know about this Health ICTs	39	27,5 %
Prefers a face-to-face relationship with a medical professional	12	8.5 %
Already have assistance (Elderly Homes or Private health system)	16	11.3 %
A familiar takes care of the medical problems	6	4.2 %

Table 13 – Descriptive Statistics: Reasons for not Using Health ICTs

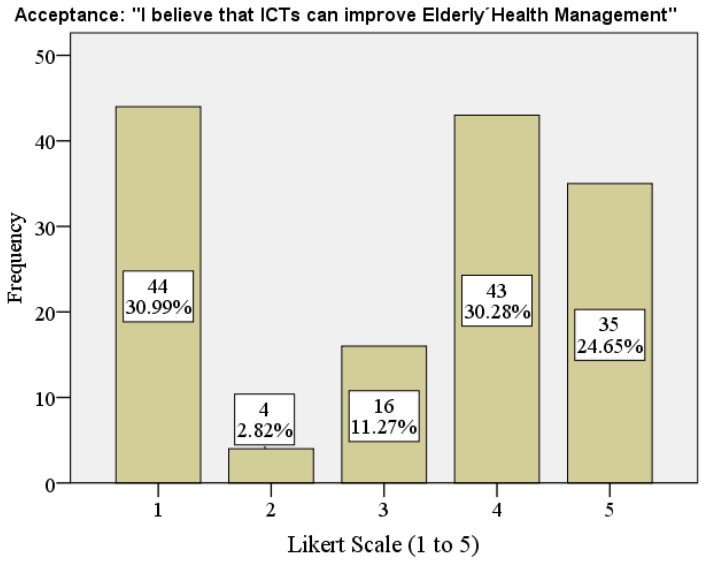
Senior Universities can have a positive impact in promoting the use of health ICTs, as we saw in the previous analysis, educating how to use a computer and search. Additionally, and extremely vital, Senior Universities and leisure elderly spaces can have an active role in communicating the existence of this solutions that elderly can have access, improving their life in general.

The collection of information permitted to understand that people don´t know about the existence of this innovations, second most mentioned reasons for not using. Although, for future elderly generations health ICTs will have an active role, leading a new way of health management and relationship patient-medical professionals, permitting information sharing and remote assistance.

6. Acceptance of Health ICTs: Descriptive Statistics Analyze

The Acceptance of Health ICTs by the Elderly population is vital to promote the implementation and good use of technologies in their health and life management, as analyzed in literature review. To evaluate the acceptance of Health ICTs in the questionnaire it was asked to participants to evaluate 1 to 5, Likert scale, the degree that they agree that Health ICTs could improve health management of the Senior and Elderly population.

Answers collected where organized in a bar chart, presented in figure 17. It is possible to visualize three different groups. First one with a negative evaluation, with forty-four participants (31%) giving 1 point and four 2 points (3%). Another sixteen participants provided an average evaluation (11,3%) and seventy-eight participants, representing about half of the population (55%), evaluation 4 and 5 points, agreeing that Health ICTs can improve health management of senior citizens.



Mean	3.18
Std. Deviation	1.556
N	142

Figure 17 – Bar Chart: Likert Scale evaluation of Health ICTs

In appendix, tables 37 to 43, it is presented the crosstabulation between the answers to the acceptance evaluation and moderator variables as age, gender, health condition, educational level, profession and experience using ICTs to understand the characteristics of subject that demonstrated higher acceptance of Health ICTs.

AGE: Younger elderly tends to better accepted Health ICTs. Subjects aged between 60 to 80 represents 82% and 88% of 4 and 5 points evaluation. In opposition, participants aged over 80 represented 65% of elderly that evaluated 1 point. (Appendix Table 37)

GENDER: In terms of gender, women interviewed provided a more positive evaluation then mans, representing 71% of the total of participants answering 5 points. (Appendix Table 38)

HEALTH CONDITION: The acceptance can depend on the health condition, people with better health tend to have lower necessity and acceptance of health ICTs. Participants with 4 points health condition represent 49% of who votes 1 point. (Appendix Table 39)

LIVING WITH: Elderly that evaluated 5 points to the acceptance 56% lives with family and 32.4% alone. Results analysis show that elderly living with a partner tend to have an higher acceptance, possible because of social influence. (Appendix Table 40)

EDUCATION: Subjects with Academic education level tend to accept more positively health ICTs then the ones with basic education. In a total of twenty-nine participants with academic education level, twenty evaluate 4 and 5 points, representing 70% of academics. In opposition, only thirty-four out of seventy-two participants with basic education gave a positive evaluation, representing only 47%. (Appendix Table 41)

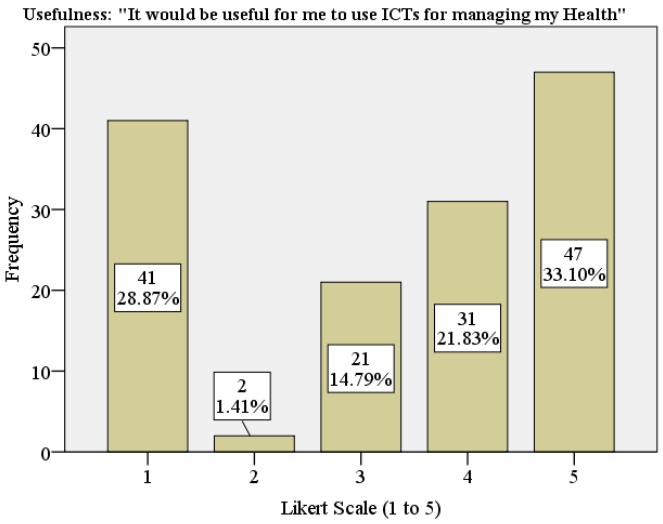
PROFESSION: It is not possible to affirm that qualified professions have a higher acceptation of Health ICTs, depending on other factors as age and health condition (Appendix Table 42)

USER PROFILE: Concerning Experience using ICTs and Users Profile, it is possible to affirm that elderly with more experience using ICTs tend to have a more positive acceptance. This saying, only 34% of elderly with experience using ICTs evaluated Health ICTs above 3 points. In opposition 100% of advanced users evaluate above 3 points, 60% five points and 40% 4 points. 80% Intermediate users evaluate above 3 points. (Appendix Table 43)

6.1. Usefulness Expectancy

To evaluate Usefulness expectancy of elderly it was asked their agreement regarding “It would be useful for me to use ICTs for managing my Health ICTs”, in a scale 1 to 5.

Answers collected, presented in figure 18, permits to understand that major part of participants (54%) perceive Health ICTs as useful by classifying above thee points (22% four and 33% five points), although there still forty-one participants (29%) giving only one point evaluation, perceiving that the use of ICTs for managing their health is not so useful, so it would be interesting to understand the profile of this participants trough cross tabulating answers with different variables**.**



Mean	3.18
Std. Deviation	1.484
N	142

Figure 18 – Bar Chart: Likert Scale evaluation of Usefulness Expectancy

AGE: It is possible to evidence that younger elderly perceives usefulness of health ICTs more positively then older ones. 65.5% of elderly aged between sixty and seventy and 82% aged between seventy and eighty gave an evaluation above 3-points. In opposition, 67% of elderly aged between eighty and answer under 3-points regarding their usefulness expectancy of Health ICTs. (Appendix Table 44)

GENDER: Women perceive as more useful the use of technologies for manage their health. 26% of female participants evaluated 5-points Usefulness Expectancy, in opposition to only 11% of mans. The difference in gender is even greater regarding negative evaluation, where 63% of mans and only 165% answered 1-point evaluation. (Appendix Table 45)

HEALTH CONDITION: Elderly that evaluate their health negatively tend to evaluate more positively usefulness expectancy of health ICTs, higher then elderly with good health. According the analysis of Appendix Table 46, 45% of participants that evaluated their health in 2-points, out of 5, gave a 5-point evaluation of usefulness expectancy. In opposition, the same evaluation represents only 15% of elderly with a good health, evaluated in 5-points.

LIVING WITH: Elderly living alone then to accept more positively health ICTs then the ones living with family, partner and elderly homes. 23,3% of subjects living alone evaluate 5-points, in contracts to 22.22% to the ones living family, 20.3% living with a partner and zero

percent to the ones in elderly homes, possible because they have health assistance and are not alone. (Appendix Table 47)

EDUCATION: 69% of subjects with academic level evaluate above 3-points and the percentage for basic education subjects is only 53%, representing a difference of 16%. Academics tend to have a more positive usefulness expectancy. (Appendix Table 48)

PROFESSIONS:

Type of Profession	Likert Scale: Evaluation above 3-points (4 and 5)		Number of Participants
	Percentage	Frequency (positive evaluation)	
Domestic	76.9%	10	13
Professor and Intellectual Profession	72.7%	8	11
Not Qualified	66.7%	20	30
Independent Business Owner	66.66%	2	3
Health professionals	58,33%	7	12
Technical	47%	24	51
Qualified	45.5%	10	22

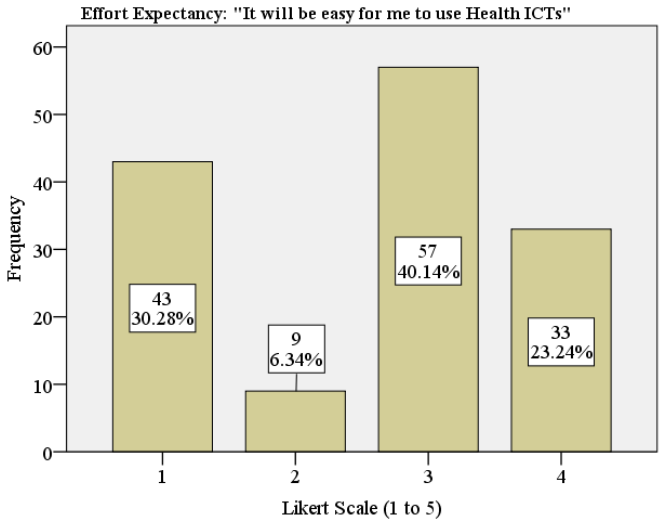
Table 14 – Relationship between Type of Profession and Usefulness Expectancy

According table 14, it is possible to see that Professors and Intellectual Professions, Independent Business owners and health professionals have a high percentage, above half of the population of each profession perceiving as useful health ICTs. Although, results show us that qualified professions that now have a higher percentage than not qualified. This could be explained as there are other factors influencing, as age and gender. The same crosstabulation analysis will be made to effort expectancy to understand if elderly that qualified professions during life perceive technologies as easier to use. (Appendix Table 49)

6.2. Effort Expectancy

To understand how difficult elderly, perceive the use of Health ICTs, it was asked in the questionnaires the level that they agree with the affirmation "It will be easy for me to use Health ICTs". Instead of asking "it will be difficult (..)" the affirmation was formulated in a positive way to not induce that Health ICTs are difficult to use. Having this in mind, evaluations under 3-points means that elderly have an expectation that it will be difficult to use Health ICTs.

By analyzing the bar chart presented in figure 19, it is possible to induce that 36.5% of the elderly interviewed perceive that it will be difficult for them to use Health ICTs, evaluating 1-point (30,3%) and 2-points (6.34%). In opposition, only 23,24% of subjects interviewed perceived that it will easy to use, evaluating 4-points.



Mean	2.56
Std. Deviation	1.151
N	142

Figure 19 – Bar Chart: Likert Scale Evaluation of Effort Expectancy

AGE RANGE: In terms of age, younger elderly (60 to 80) perceive as easier the use of Health ICTs then older ones aged over 80 years old). Curiously, 62,8% of elderly aged between 80 and 90, 27 subjects out of 43, gave 1-point evaluation. (Appendix Table 50)

GENDER: We can evidence that there is a higher percentage of female gender (26.6%) perceiving as easy the use of Health ICTs then male gender (19%), according the analysis of 4-points effort expectancy evaluation. (Appendix Table 51)

EDUCATION LEVEL: Academic (20.7%), high school (22.2%) and technical courses (26.1%) are the education levels that registered lower percentage of elderly perceiving as difficult the use of Health ICTs, answering 1-point evaluation. In opposition, the percentage of basic education is the highest (37.5%). (Appendix Table 52)

TYPE OF PROFESSION: In terms of the relationship between type of professions and effort expectancy, health professionals recorded higher percentage of subjects considering as easy to use. Although, not qualified professionals registered higher percentage then qualified ones. This can be explained as other variables may influence, for example age, as presented in the next page, table 15.

Additionally, senior universities students with not qualified professions could perceive as easier the use of Health ICTs. (Appendix Table 53)

Type of Profession	Likert Scale: Evaluation above 3-points (4 and 5)		Number of Participants
	Percentage	Frequency	
Health professionals	41.6%	5	12
Not Qualified	40%	12	30
Domestic	38%	5	13
Professor and Intellectual Profession	36%	4	11
Independent Business Owner	33.3%	1	3
Qualified	13.6%	3	22
Technical	5.8%	3	51

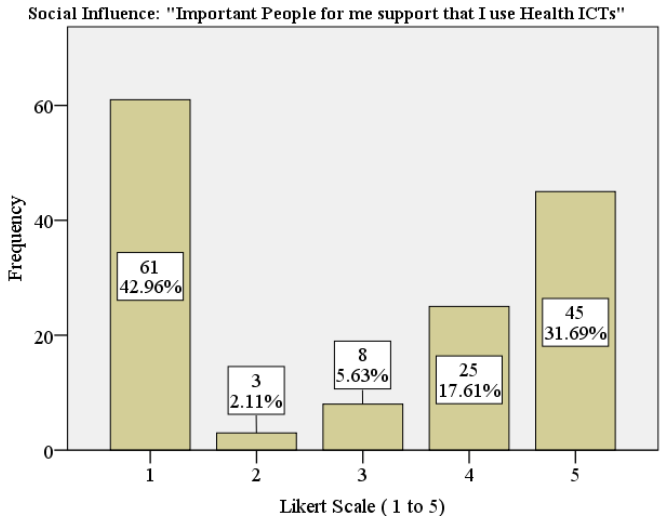
Table 15 – Relationship between Type of Profession and Effort Expectancy

Experience Using ICTs: Elderly that does not use ICTs have a higher effort expectancy then the ones that already use or even are advanced users, feeling familiar with computer and tablet.

The crosstabulation between Profile users and usefulness expectancy, presented in Appendix Table 54, evidence that advanced users only evaluated effort expectancy above 3-points where 60% evaluates 4-points. Advanced users are a minority group, with only 5 individuals, in opposition to elderly that does not use ICTs. In opposition, only 31.8% of intermediate users and 38.1% basic users evaluated as easy the use of Health ICTs.

6.3. Social Influence

According the analysis of figure 20, presented in the next page, there is a percentage of 43% of elderly interviews, 61 out of 142 subjects, that assumes not having enough social influence and incentive of important people for using Health ICTs. Although, another group of twenty-five(17.6%) and forty-five individuals answer positively that they have important people that incentive and supports the use of Health ICTs, what can lead to the use of Health ICTs.



Mean	2.90
Std. Deviation	1.550
N	142

Figure 20 – Bar Chart: Likert Scale evaluation of Social

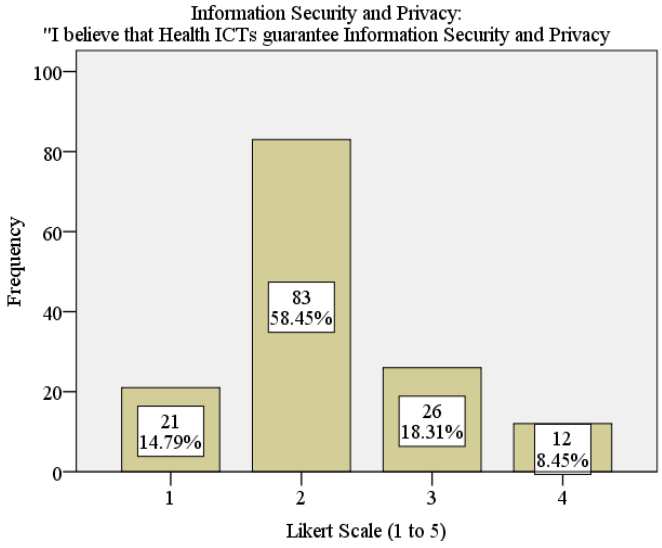
AGE: Younger elderly aged between 60 to 80 consider having a positive social influence, with more then half of this group giving an evaluation above 3-points, in opposition to only 16 of subjects aged between 80 and 90. (Appendix Table 55)

GENDER: Even the social influence percentage difference between genders is not a large difference, but female demonstrated to have better assistance. (Appendix Table 56)

LIVING WITH: Elderly living alone (37,2%) and in elderly homes (29.4%) consider having low social influence, evaluating only 1-point, then the ones living with family (27.8%) and with a partner (25%). (Appendix Table 57)

6.4. Information Security and Privacy

The bar chart presented in figure 21 permits to understand that Information Security and Privacy of Health ICTs is a concern among elderly interviewed, where only 12 participants gave a positive evaluation, trusting information security and privacy.



Mean	2.20
Std. Deviation	0.795
N	142

Figure 21 – Bar Chart: Likert Scale evaluation of Information Security and Privacy

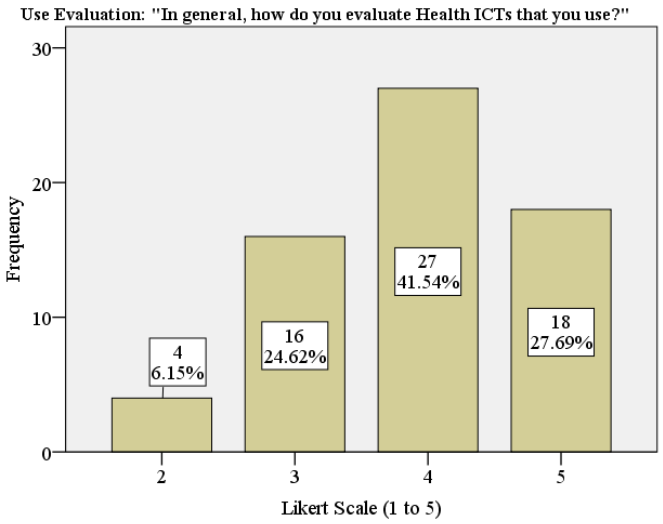
AGE: According Appendix Table 58, younger elderly aged between 60 and 90 represent the subjects that gave a positive evaluation.

GENDER: Even the difference is not substantial, 49 female subject (59% of female group) evaluating 2-points and 34 male subjects (41% of mans), inducing that females have higher concerns regarding information Security and Privacy of Health ICTs. (Appendix Table 59)

EDUCATION: Only 48% of academics provided a negative evaluation under 3-points, registering a relevant different to basic education (85%), high school (78%) and technical courses (65%). (Appendix Table 60)

7. Use of Health ICTs: Descriptive Statistics Analyze

To evaluate the experience of the 65 subjects interviewed that use of Health ICTs in a Likert Scale 1 to 5 it was asked “in general, how do you evaluate the Health ICTs that you use?”, where answers are presented in the chart presented in figure 22.



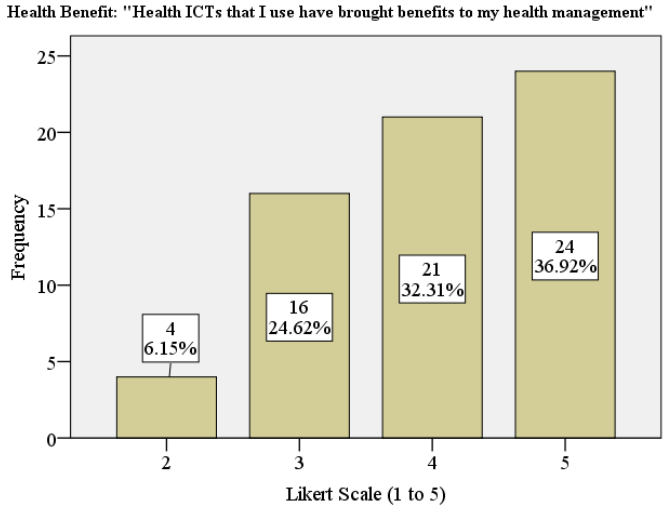
Mean	3.91
Std. Deviation	0.879
N	65

Figure 22 – Bar Chart: Likert Scale evaluation of Health ICTs Use

According the analyze of figure 22, 45 subjects out of 65 (almost 70%) have a positive evaluation of Health ICTs that they use. Although, there still 16 subjects with 3-points evaluation and 4 negatively evaluating 2-points, possible to a negative experience they had. To better understand the use, it will be analyzed the questionnaires variables as health benefits perception, usability and facilitator conditions as assistance and access to Health ICTs.

7.1. Perception of Health Benefits

It was to the participants, in scale 1 to 5, if they agree that “Health ICTs that I use have brought benefits to my health management”. Answers are presented in figure 23.



Mean	4.0
Std. Deviation	0.935
N	65

Figure 23 – Bar Chart: Likert Scale Perception of Health ICTs

In a 1 to 5 Likert scale evaluation, where 5 means to totally agree and 1 not agree, twenty-four (41,5%) and eighteen (27,7%). In comparison to figure 15, health benefits have higher percentage of 5 and 4-points evaluation. This means that elderly perceive this solution as beneficial for their health, but there can be barriers in use as usability and access to assistance.

A**GE:** Subjects aged between 60 and 80 represent 80% of 4-points evaluation and 58% of 5-points. This younger age range have higher number of users. Although, in a total of 5 users aged between 80-90, 4 evaluated positively health benefits. (Appendix Table 61)

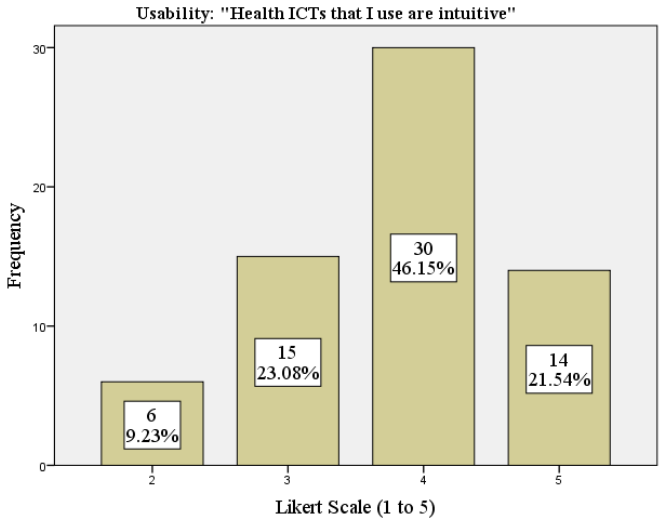
GENDER: First, there is a higher percentage of man's not using (66.7%) health ICTs then female gender (44.3%). Additionally, male gender tends to evaluate health benefits of health ICTs lower than women. 70% of 5-points evaluation are women. (Appendix Table 62)

HEALTH CONDITION: Health ICTs can be more useful for elderly with less positive health evaluation, 68.5% of elderly with 2-points evolution of health condition evaluate positively and 94% of not users evaluate their health in 3 or 4-points. (Appendix Table 63)

LIVING WITH: 47% of Elderly living alone evaluate 5-points the perception of health benefit, in opposition to 18.2% living with family, 37.5% with a partner. (Appendix Table 64)

7.2. Usability Evaluation

To understand the usability of Health ICTs according the perception of Elderly, it was asked in the questionnaire to the participants the degree that they agree that "Health ICTs that I use are intuitive", this meaning easy to use. The answers collected are presented in figure 24.



Mean	3.80
Std. Deviation	0.887
N	65

Figure 24 – Bar Chart: Likert Scale evaluation of Health ICTs Use

In general, elderly consider Health ICTs easy to use, where majority of them (22% 5-points and 46% 4-points) use simple systems as health teleassistance (saúde24). Although, we can understand that the 15 users that evaluated 3-points and 6 subjects 2-points face difficulties in using health ICTs, so it will be to necessary to understand the profile of this subjects.

AGE: Younger users aged between 60 and 70 perceive as intuitive the use of health ICTs, with twenty-one subjects evaluating 4 points and seven 5-points. (Appendix Table 65) **GENDER:** Female gender have higher evaluation of health ICTs then mans. (Appendix Table 66)

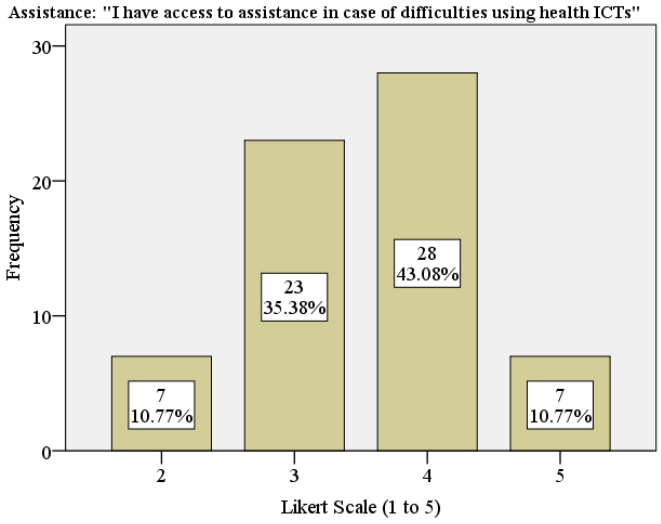
EDUCATION: It was not possible to evidence that elderly with high education level evaluate more positively Health ICTs usability. (Appendix Table 67).

PROFESSION: Appendix Table 68 show that there is a higher percentage of not qualified professionals evaluating more positively Health ICTs usability then qualified professionals.

EXPERIENCE USING ICTs: Elderly with higher experience using ICTs have a more positive usability evaluation. Although, it is not necessary to be an advanced user to use health ICTs, where ten subjects with basic experience evaluated 5-points.
(Appendix Table 69).

7.3. Access to Assistance

Figure 25 illustrates the answers when asking if participants agree that "I have access to assistance in case of difficulties using health ICTs", evaluating the access to use assistance.



Mean	3.54
Std. Deviation	0.831
N	65

Figure 25 – Bar Chart: Likert Scale Evaluation of Assistance

It is possible to understand that 46% of the elderly interviewed that use Health ICTs not have access to a good assistance, where seven subjects (11%) evaluated 2-points and other twenty-three subjects (35.3%). Only 7 subjects, 11% of users, evaluated their assistance in 5-points.

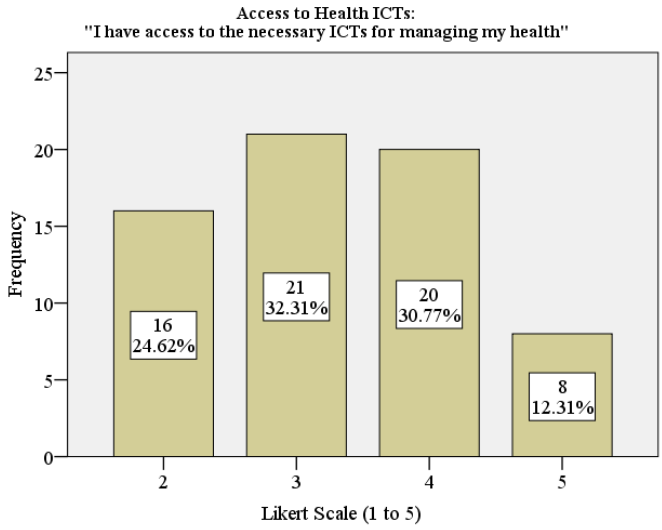
AGE: Younger elderly aged 60-70 evaluated more positively assistance then older ones. 29% of elderly with this age evaluated 4-points and 70-80 only 7%. (Appendix Table 70).

GENDER: 14% of women that use Health ICTs, 11 subjects, evaluated negatively assistance with 2-points and man only 8%, 5 subjects, evidencing that female interviewed have a lower assistance in case of problems using health ICTs then mans. (Appendix Table 71).

LIVING WITH: Elderly living with a partner have a better health assistance than the ones living alone. 17.2% of elderly living with partner evaluated 4-points assistance, in opposition to 14% of the ones living alone. (Appendix Table 72).

7.4. Access to Health ICTs

It was asked to questionnaire participants that use Health ICTs if they "have access to then necessary ICTs solutions for managing their health. Figure 26 frames the different answer where it is evidenced that 57% of users do not have access to the necessary Health ICTs.



Mean	3.31
Std. Deviation	0.983
N	65

Figure 26 – Bar Chart: Likert Scale Evaluation of Assistance

AGE: 21 subjects aged between 60-70, in a total of 39, evaluated the access to Health ICTs in 4 and 5-points. Only 10 aged between 70-80, in a total of 21, provided positive evaluation, demonstrating that younger elderly more access to Health ICTs. (Appendix Table 73).

GENDER: 71.4% of women evaluate 4-points Access to Health ICTs, to 38% of mans. Female gender interviewed have a better access to Health ICTs. (Appendix Table 74).

EDUCATION: 5 subjects out of 18 with academic background evaluated 5-points and none of basic education. Although, there is higher number with basic education evaluating 4-points, so it is difficult to stablish a conclusion. (Appendix Table 75).

PROFESSION: Health Professionals consider having a good access to health ICTs, with 6 subjects in a total of 7 users evaluating 4-points. Although, in a total of 8 qualified professionals

using Health ICTs, only 2 evaluated 2-points, where 8 not qualified classified 4-points. In fact, 3 not qualified classified 5-points, concluding that not qualified professionals interviewed evaluated more positively the access to health ICTs then qualified. (Appendix Table 76).

8. Analysis of the Research Model

Even the independent variables used to evaluate health ICTs Use and Acceptance were based in the literature review of the validated model developed by Venkatesh et al. (2003), it is also important to evaluate the consistency of data collected, validating the reliability associated with scores of the scale, ensuring that it is free of aleatory errors to provide consistent data, before going forward the correlation's coefficient analysis.

8.1. Internal Consistency: Cronbach Alpha Coefficient

By using IBM Statistics, it was possible to estimate the internal consistency with Cronbach Alpha Coefficient (α). For the reliability to be acceptable it should be **higher than 0.70.**

For the analysis of **Acceptance** of Health ICTs, the total of 142 cases and 5 items (Acceptance Evaluation, Usefulness Expectancy, Social Influence, Effort Expectancy and Security and Privacy). Table 16 shows that the Cronbach's alpha result is **.915,** meaning that the five items have high internal consistency.

Item Statistics	Mean	Std. Deviation	N	Cronbach's Alpha
Acceptance	3.18	1.556	142	**.915**
Usefulness Expectancy	3.18	1.484		
Social Influence	2.90	1.550		
Effort Expectancy	2.56	1.151		
Security and Privacy	2.20	.795		

Table 16 – Reliability Analysis: Acceptance of Health ICTs

Regarding the Use of Health ICTs, only 65 cases were considered, representing part of the 142 subjects interviewed that use Health ICTs. In a total of 5 items, the Cronbach's alpha result is **0.903,** as demonstrated in table 17, proving the internal consistency of use evaluation model.

Item Statistics	Mean	Std. Deviation	N	Cronbach's Alpha
Use Evaluation	3.91	.879	65	**.903**
Health Benefit	4.00	.935		
Usability	3.80	.887		
Access to Health ICTs	3.31	.983		
Access to Assistance	3.54	.831		

Table 17 – Reliability Analysis: Use of Health ICTs

8.2. Inferential Analysis: Pearson Correlations and Hypothesis Testing

After confirming the internal consistency of the model, it is finally possible to proceed to Pearson correlations coefficients analysis, identifying the strongest relationships and testing the hypothesis to make inferences. Pearson Correlation can assume values between -1 (negative), 1 (positive) and 0 (not linear dependency). Positive or negative values between **0-0.3** mean an insignificant correlation**, 0.3-0.5** weak correlation, **0.5-0.7** moderate relationship, **0.7-0.9** strong correlation and above **0.9** a very strong correlation.

8.2.1. Elderly Acceptance of Health ICTs

In order to access the strength of the correlations between the variables that influence Elderly 'Acceptance of Health ICTs a Pearson's Correlations was applied. Table 18 presented the Correlation Matrix of Health ICTs Acceptance, revealing significative correlations, including a very strong positive relationship **(0.932)** between Acceptance of Health ICTs and Usefulness Expectancy and a moderate relationship between the Acceptance Evaluation and Information Security and Privacy.

	N=142	Acceptance Evaluation	Usefulness Expectancy	Social Influence	Effort Expectancy	Security and Privacy
Acceptance Evaluation	Pearson Correlation *	**1**	**.932****	**.725****	**.880****	**.566****
Usefulness Expectancy	Pearson Correlation *	**.932****	**1**	**.729****	**.859****	**.522****
Social Influence	Pearson Correlation *	**.725****	**.729****	**1**	**.639****	**.592****
Effort Expectancy	Pearson Correlation *	**.880****	**.859****	**.639****	**1**	**.486****
Security and Privacy	Pearson Correlation *	**.566****	**.522****	**.592****	**.486****	**1**

*Sig. (2-Tailed) = 0.00 **. Correlation is significant at the 0.01 level (2-tailed).

Table 18 - Inter-Item Correlation Matrix: Acceptance of Health ICT

RQ1 - What variables influence Elderly Acceptance of Health ICTs?			
Propositions and Questions	Relationship	Pearson Correlation	Results
H1: Usefulness Expectancy can positively influence Elderly´ Acceptance of Health ICTs. Question: "It would be useful for me to use ICTs for managing my health"	Positive (+) Influence	0.932 (Significant)	Confirmed Very Strong Linear Relationship
H2: Effort Expectancy can negatively influence Elderly´ Acceptance of Health ICTs. Question: "It will be easy for me to use Health ICTs"	Negative (-) Influence	0.880 (Significant)	Confirmed Strong Linear Relationship

H3: Social influence can positively influence Elderly´ Acceptance of Health ICTs. Question: "Important People for me incentive that I use Health ICTs"	Positive (+) Influence	0.725 (Significant)	Confirmed Strong Linear Relationship
H4: Information Security and Privacy can negatively influence Elderly´ Acceptance of health ICTs. Question: "I believe that Health ICTs guarantee Information Security and Privacy"	Negative (-) Influence	0.566 (Significant)	Confirmed Moderate Linear Relationship

Table 19 - Hypothesis Testing: Elderly Acceptance of Health ICTs

H1: Usefulness Expectancy and Health ICTs Acceptance: Between the 4 constructs of Acceptance model, Usefulness Expectancy is the dimension with higher correlation (0.932), having a very strong positive influence in Acceptance. Interpreting this, elderly that gave a positive evaluation to Health ICTs Acceptance also agree that it is useful. **Hypothesis 1 is confirmed** as there is a significative statistics correlation validating that "Usefulness Expectancy can positively influence Elderly´ Acceptance".

H2: Effort Expectancy and Health ICTs Acceptance: In the order to analyze if the effort expectancy, if elderly consider difficult or easy to use Health ICTs, could influence the Acceptance of Health ICTs. The result was a positive value (0.880), when asked if subjects agree that "It will be easy for me to use Health ICTs". This mean that elderly that perceive that it will be easy to use Health ICTs also have a good Acceptance.

In opposite, it is possible to demonstrate that Elderly that perceive as difficult the use of Health ICTs will tend to have a less positive acceptance. In this perspective, we can confirm Hypothesis 2 that "Effort Expectancy can negatively influence Elderly´ Acceptance of Health ICTs.", existing a significative strong correlation.

H3: Social influence and Health ICTs Acceptance: Regarding Social Influence, we can validate Hypothesis 3 that this variable can positively influence Elderly´ Acceptance of Health ICTs, meaning if "Important People incentive the use Health ICTs" the acceptance will be more positive. There is a significative Pearson correlation, with a strong linear relationship (0.725), between 0.7 and 0.9, but lower then Effort expectancy, meaning that effort expectancy have a stronger correlation with Acceptance than Social Influence.

H4: Information Security and Privacy and Health ICTs Acceptance: As Effort expectancy, the Pearson correlation value is positive, but the aim was to study a possible negative correlation, asking in a positive way elderly for not inducing to easy negative answers. This meaning asking, "I believe that Health ICTs guarantee Information Security and Privacy" instead of "not guarantee". The Pearson correlation value shows a moderate linear relationship (0.566), between values of 0.5 and 0.7. In this way, hypothesis 4 is validated, "Information Security and Privacy can negatively influence Elderly´ Acceptance of health ICTs". The literature review of the "Unified Theory of Acceptance and Use of Technology" (Venkatesh, et al., 2003), demonstrated a positive acceptance of technologies can lead to the use, and this why de design should be developed according the user characteristics. Based on this model, it was introduced 4 variables, Health Benefit, Usability and facilitator conditions as Assistance and Access to Resources, developing 4 different hypothesis that will be tested.

8.2.1. Elderly Use of Health ICTs

By analyzing the correlation Matrix of Health ICTs Use, Table 20**,** it is possible to visualize Pearson correlation results, identifying that the stronger relationship **(0.874)** is between Health Benefit and Use Evaluation. Additionally, there is also a significant correlation between usability, assistance and access to resources with use evaluation. In the next paragraphed the hypothesis regarding the Use of Health ICTs will be interpreted, according table 21.

	N=65	Use Evaluation	Health Benefit	Usability	Assistance	Access to Resources
Use Evaluation	Pearson Correlation *	**1**	**.874****	**.837****	**.754****	**.558****
Health Benefit	Pearson Correlation *	**.874****	**1**	**.734****	**.724****	**.459****
Usability	Pearson Correlation *	**.837****	**.734****	**1**	**.636****	**.591****
Assistance	Pearson Correlation *	**.754****	**.724****	**.636****	**1**	**.406****
Access to Resources	Pearson Correlation *	**.558****	**.459****	**.591****	**.406****	**1**
*Sig. (2-Tailed) = 0.00 **. Correlation is significant at the 0.01 level (2-tailed).						

Table 20 - Inter-Item Correlation Matrix: Use of Health ICTs

RQ1 - What variables influence Elderly Use of Health ICTs?			
Propositions and Questions	Relationship	Pearson Correlation	Conclusion
H5: Health Benefit can positively influence Elderly´ Use of Health ICTs Question: "Health ICTs that I use have brought benefits to my health management"	Positive (+) Influence	0.874 (Significant)	Confirmed Strong Linear Relationship
H6: Usability can positively influence Elderly Use of Health ICTs Question: "Health ICTs that I use are intuitive"	Positive (+) Influence	0.837 (Significant)	Confirmed Strong Linear Relationship
H7: Access to Assistance can negatively influence Elderly´ Use of Health ICTs Question: "I have access to assistance in case of difficulties using health technologies"	Negative (-) Influence	0.754 (Significant)	Confirmed Strong Linear Relationship
H8: Access to Health ICTs can negatively influence Elderly´ Use of Health ICTs Question: "I have access to the necessary technologies for managing my health"	Negative (-) Influence	0.558 (Significant)	Confirmed Moderate Linear Relationship

Table 21 - Hypothesis Testing: Elderly Use of Health ICTs

H5: Health Benefit and Health ICTs Use Evaluation: The hypothesis that Health Benefits can positively influence Elderly´ Use of Health ICTs is validated, with a significant Pearson correlation (**0.874),** the highest between the 4 variables influencing Health ICTs Use, demonstrating a strong linear relationship. Elderly that agree with the affirmation "Health ICTs that I use have brought benefits to my health management" also evaluate positively the use experience. The highest the health benefit the better will be the use evaluation.

H6: Usability and Health ICTs Use Evaluation: Usability evaluates if elderly users perceive that the health systems that they use are or not simple and intuitive. There is a significant strong linear relationship (person correlation of **0.837)**, although lower than Health benefit. Hypothesis 6 is validated, usability can positively influence Elderly Use of Health ICTs,

meaning that as easier it will be to use technologies “Health ICTs that I use are intuitive”, the better will be the user evaluation.

H7: Access to Assistance and Health ICTs Use Evaluation: There is a significant correlation between Access to Assistance “I have access to assistance in case of difficulties using health technologies” and Health ICTs Use Evaluation. Pearson correlation tests evidence a strong linear Pearson correlation relationship (**0.754),** although lower than health benefit (**0.874)** and usability (**0.837)**. It is possible to validate Hypothesis 7, in cases that assistance is not provided, the use evaluation will be negatively influenced.

H8: Access to Health ICTs Use Evaluation: The Pearson correlation result (**0.558**), is between 0.5-0.7, meaning a moderate relationship. Even the value is positive, the hypothesis was built as a negative influence. The aim is to understand the influence of access to necessary Health ICTs for a good use evaluation, asking in the positive way if elderly interviewed “have access to the necessary Health ICTs for managing their health”. Hypothesis 8 is validated with a significative correlation, evidencing that in cases that Elderly don´ have access to the necessary Health ICTs the use evaluation is negatively influenced.

9. Conceptual Framework: Correlations Results

In order to provide a visual understanding of the Pearson Correlations results and the dynamic interaction between the variables that influence Elderly Use and Acceptance of Health ICTs, a Conceptual Framework is presented in figure 27 (Research Question 1, Acceptance of Health ICTs) and figure 28 (Research Question 2, Use of Health ICTs).

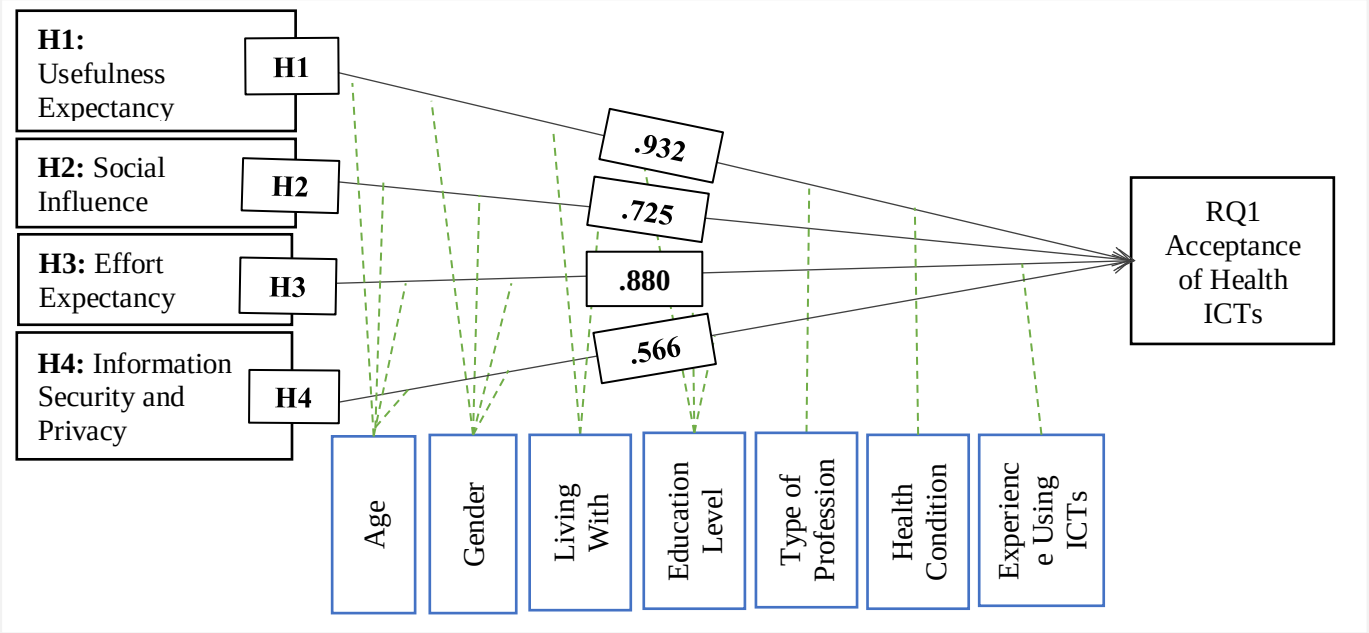


Figure 27 – Conceptual Framework: Acceptance of Health ICTs

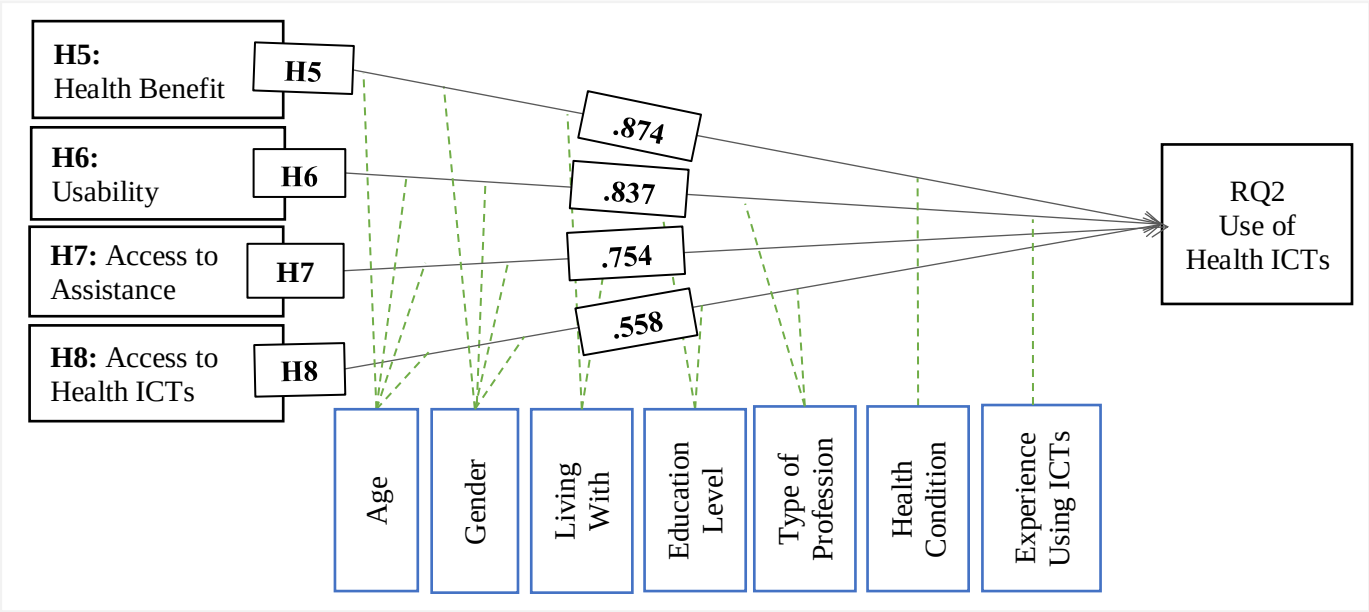


Figure 28 – Conceptual Framework: Use of Health ICTs

Chapter VII – Forms of Implementation

In this Chapter it will be presented the Health ICT solution that Altice is implementing for domiciliary Health remote monitoring "SmartAl – Smart Assisted Living" as well as the summary of valid opinions of three health professionals, Mr. **Francisco Frazão**, *Surgical Manager at Champalimaud Fondation***,** Mr. **Gonçalo Duarte**, *Medical Doctor at Centro Hospitalar Lisboa Norte* and Mr. **Miguel Fernandes**, *Chief Nursing Officer in Cascais Clinical Center with a PhD in Public Health Administration*, regarding "What is your opinion regarding the application of Health ICTs for Elderly Healthcare Management".

1. Altice´ Health ICT Solution: "SmartAl – Smart Assisted Living"

Understanding the challenges of Elderly Healthcare management in Portugal, Altice recently developed "SmartAl – Smart Assisted Living" (website in footnote) (logo in figure 29), a Health ICT platform for Elderly domiciliary healthcare management, including vital signs monitoring, connecting patients, formal caregivers, medical professionals and informal caregivers for improving health information sharing.

Figure 29 – SmartAl Logo

1.1. SmartAl: Concept and Services Provided

With a dynamic architecture and functionalities, it is possible to program the platform according the specific health user 'needs, with a diverse offer of services as vital signs telemonitoring, notifications, alerts and alarms for facilitating health daily activities management and assistance in case of health emergency, surveys, health tutorials or videoconferencing.

Vital Signs Remote Monitoring: Health data is fundamental for a good health management, permitting health professionals to do better decisions based on clinical records, as well as improving treatment measurement, chronic diseases monitoring and health prevention. This platform can be connected to different devices in home, trough wireless technologies, measuring vital signs (including weight, blood pressure, pulse or glucose) in real-time and providing accurate health data that can be accessed digitally by authorized caregivers. Minimum and maximum values considered as normal for vital signs can be pre-programmed, where alerts can be activated in case of unnormal measurements. The platform

can also present statistical graphics and reports to inform and facilitate the analysis of vital signs evolution during time.

Reminders, Notifications and Alarms: To facilitate elderly daily activities management reminders and notifications can be programmed, helping elderly to not forget important health tasks. If tasks are not being completed or signs of inactivity, an alarm can be sent to family and caregivers.

Online Surveys: The objective to implement online surveys in the platform is to assess psychological or physic well-being, understanding possible problems that elderly may have and reducing problems related to isolation. Additionally, elderly may face social barriers to share their problems and by using this indirect tool they may feel more open to share personal then face-to-face communication. Online Surveys can be useful as an extra-assistant, although does not substitute personal assistance.

Domotic and Home Automation: The development of domotic technologies are permitting citizens with reduced mobility and disabilities to stay in the comfort and safety of home, instead of costly elderly homes, maintaining an independent living and having control of home functionalities such as doors, lighting or air conditioning. This is possible using sensors and wireless technologies, creating an innovative concept of smart homes, being capable to detect and alert in case of falls or security problems, also reducing family concerns regarding the well-being of their loved ones when they not present and being alerted in case of emergencies.

Telehealth Video Conferencing: In order to improve health assistance and provide an innovative remote medical assistance, Altice is developing a video conferencing feature integrated in SmartAl platform, as a solution to reduce costs with unnecessary health travels costs, improve prevention care and assistance in case of daily health problems, permitting online diagnosis and health teleconsulting.

Interactive Health Tutorials: In order to provide knowledge for a good health management and healthy attitudes, SmartAl platform includes an area with health tutorials using videos and interactive content, creating a learning experience to all users regarding relevant topics as chronic health conditions, cognitive health, nutrition, physic exercise and health prevention.

1.2. SmartAl: Users

For elderly and chronic patients this platform permits to monitor vital signs in home, as well as facilitating daily management of health activities, providing support notifications, reminders and alerts, also facilitating the communication with all stakeholders, as presented in figure 30, reducing isolation and even providing technologies for home automation, promoting a more active and independent living.

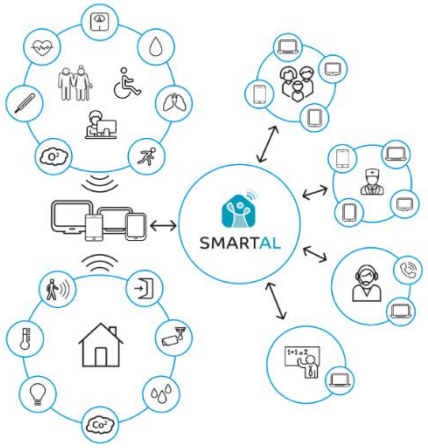


Figure 30 – SmartAl Stakeholders Map

This platform can also facilitate formal caregiver's assistance, Private Social Solidarity Institutions "IPSS" or Health Caretakers Institutions, providing a set of tools to improve team's management efficiency for a better allocation according the tasks and being able to more patients, providing also training and coaching trough the platform. Additionally, by sending notifications and reports when tasks are completed to family members, this adds value to formal caregiver's assistance and comfort to the patient relatives.

Unformal Caregivers, family members or friends that provide health assistance to elderly, can also have an important role. This solution aims to provide a higher comfort to unformal caregivers, informing if elderly is completing daily tasks and alerting in case of unnormal vital signs values as well as in case of emergency situations. Additionally, as a network platform, it facilitates the communication between all the intervenient, including health professionals as doctor and formal caregivers.

SmartAL is certified for hospital use, permitting health professionals to have access to each patients' vital signs records, providing accurate health data for monitoring chronic diseases, management treatments progress and improve health prevention. As each patient has their own profile and health records, information that be access by multiple authorized health professionals, facilitating information sharing between public and private health institutions. Additionally, innovative technologies as telehealth videoconferencing and other technologies can mitigate distance barriers, improving communication with patients.

For Public health Service, SmartAl aims to have a positive contribution to reduce high costs associated with unnecessary hospitalization and medical visits.

1.3. SmartAl: Interfaces and how to use

This platform can be used in multiple interfaces, including Television, computer, tablet or smartphone (figure 31). By analyzing the answers to the questionnaire, it was possible to understand that Television is commonly used by Portuguese elderly, among different genders, ages or education level. At home, it is possible to login into the platform using the television command. Each user will have their profile, username and password, where different family members can use the same platform, being developed as a simple and intuitive platform.

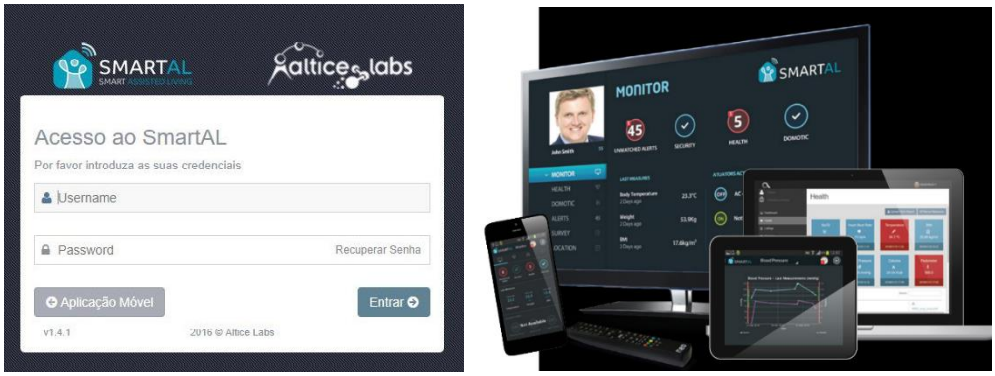


Figure 31 – SmartAl platform Login area and Interfaces

Once completed the login it is possible to enter in the personal profile, open notification, alerts and visualize graphics presentations of the vital signs data progress recorded by sensors and devices connected to the platform trough wireless. It is also possible to introduce manually the values of measurement collected with devices that cannot be connected.

Initially, for the system setup and pre-preprogramming, the collaboration of health professionals is fundamental, adapting the functionalities according the health needs of the user. For specific impairments, Altice has a multiple assistive technology that can be work together with SmartAL platform, for example braille software (Altice Jaws) or voice bots.

Health Professionals need to collaborate on the system setup and pre-programming of health information and alerts, adapting the functionalities according the health needs of the user. Altice has a multiple assistive technology available as eyes or voice control can be implemented in the software.

2. Health Professionals Interview

In this research had the opportunity to exchange ideas with three health professionals, Mr. Francisco Frazão, Mr. Gonçalo Duarte and Mr. Miguel Fernandes, in order to understand their opinion about the potential benefits and obstacles of Health ICTs for Elderly Healthcare Management, as both use Health ICTs in their work routine.

Mr. Francisco Frazão**,** *Surgical Manager at Champalimaud Foundation,* is a mechanical engineer that works in the development of a domiciliary remote health monitoring robot for Champalimaud´ patients using telemedicine and video conference technologies for health monitoring in domiciliary of palliative and chronic patients with health conditions that require assistance but without need of being hospitalized in the foundation´s facilities. improving flexibility, proximity and quality of health assistance. This solution permits to increase the number of patients, as the number of hospitalization beds in the facilities is limited, as well reducing costs associated with doctor's visit, diagnosing remotely the patient. This robot can be programmed to answer to each patient health situation.

Mr. Goncalo Duarte, *Medical Doctor at "Centro Hospitalar Lisboa Norte (EPE),* shared that the use of information and communication systems, as electronic clinic process software, is nowadays part of medical routine, simplifying clinic workflow, improving information communication and reducing paper use. Although, this system still complex with multiple functions (urgencies, treatment and internment management). About telemedicine and remote monitoring of vital signs, the opinion was positive, being a solution for a more efficient monitoring of chronic patients and manage treatments, providing detailed information on real time, as well as mitigating distance barriers. Although, there still a lack of trust and inertia from older medical professionals for the use of Health ICTs, having the fear of not providing a proper assistance and preferring personal contact with patients instead of videoconferencing. Another important topic analyzed was the risks of information security and privacy and the importance of assuring that health information is only available for authorized professionals.

Mr. Miguel Fernandes, *Chief Nursing Officer in Cascais Clinical Center with a PhD in Public Health Administration,* refereed that the Portuguese health system sustainability is threatened with increased costs associated with hospitalization, as elderly live more years but without a good health quality, due to a poor health monitoring and prevention. The solution proposed includes domiciliary strategies for active ageing, that include Health ICTs, enabling an efficient health monitoring of chronic illness, facilitating tasks management, stimulating intellectual cognitive capabilities, allowing communication trough distance as social network and social integration from home, reducing isolation and risks of depression, that can make the difference in case of health recuperation. Active elderly that are integrated in society, with access to resources for communicating will live longer and with a proper health assistance, healthfully.

Chapter VIII – Conclusions

This research permitted to understand that Health ICTs, as Altice´ telemedicine Health ICT solution "SmartAl-Smart Assisted Living", can have an important role in the Healthcare sector modernization.

Even the actual elderly generation still facing challenges using ICTs due to lack digital skills, domiciliary remote monitoring systems and telemedicine can be an alternative solution for costly and uncomfortable hospitalization, permitting a constant health monitoring and improving the communication and information sharing. SmartAl platform aims not only to improve patient's assistance but connecting all the stakeholders (health professionals, formal and informal caregivers), providing value by increasing efficiency and facilitating their work.

For Health professionals, this platform aims to facilitate access to patient's profile, providing accurate health information and graphic presentations for simplifying interpretation, facilitating clinic workflow and increasing efficiency, permitting information sharing between public and private health institutions. This platform can provide alerts in case of emergencies or vital signs values under or above a pre-programmed value. Additionally, by permitting communication trough distance with patients, this platform can mitigate distance barriers.

For formal caregivers, as private social solidarity Institutions that provide domiciliary health assistance to multiple patients, the use of SmartAl platform can increase team's management efficiency by facilitating tasks delivery and providing reports when completed, that can be shared with relatives for their comfort. Additionally, training content can be shared trough the platform to qualify members to provide a better assistance.

For unformal caregivers, as family and friends that are involved in the health management of elderly patients, SmartAl platform can provide health notification and alerts informing about the routine of their loved one, increasing comfort when elderly are alone.

In the next paragraphs will be addressed the conclusions regarding **(i)** Research questions and Questionnaire results, **(ii)** Improvement recommendations for SmartAl Platform and **(iii)** Study limitations and further research recommendations.

(i) Research Questions and Questionnaire Conclusions

Based on the Unified Theory of Acceptance and Use of Technology (Venkatesh, et al., 2003), a conceptual framework was developed in order to answer to two research questions:

Research Question 1: What variables influence Elderly Acceptance of Health ICTs?

Research Question 2: What variables influence Elderly Use of Health ICTs?

Regarding the variables that influence Acceptance of Health ICTs, it was possible to validate the four proposed hypotheses. This meaning, **Usefulness Expectancy** and **Social Influence** can positively influence the Acceptance of Health ICTs and, in opposition, **Effort Expectancy** and **Information Security and Privacy** can have a negative influence**.**

The Pearson tests permitted to evidence that usefulness expectancy is the variable with the highest correlation, with a very strong value of 0.932, followed by a strong correlation of effort Expectancy (0.880) and Social Influence (0.725). Information Security and Privacy has a moderate correlation influence of 0.566, the lowest. Interpreting this result, for a positive acceptance of Health ICTs the most important is that Elderly have the expectation that this solution useful for managing their health, even it may not be easy to learn how to use this solution and having concerns regarding information security and privacy. The support of family and friends, social influence, can also lead to a positive acceptance of Health ICTs

About the Use of Health ICTs, it was possible to assess that **health benefit** and **usability** have a positive influence, with a strong relationship (0.874 and 0.837 Pearson correlation values, respectively), **Access to assistance** a strong negative influence (0.754 Pearson correlation value) and **Access to health ICTs** a moderate relation (0.588 Pearson correlation value).

If the use of Health ICTs leads to an improvement of health, the use evaluation will be positive. This technology should be intuitive and adapted to the user needs, being important that the necessary assistance and health ICTs tools are provided for a good use experience.

Regarding the Questionnaire results, it is possible to evidence that ICTs are part of elderly routine for communication and entertainment. Although, there is a generations difference in terms familiarity with technology, where participants aged between 60 to 70 years old use computer, smartphone and tablet use, and, in opposition, older one's preferring to use only simpler ICTs as television and landline phone. Additionally, participants with higher education level and qualified or intellectual professions expressed higher familiarity using computer or tablet, supposing in they had the opportunity to learn how to ICTs.

The experience of visiting senior universities permitted to evidence that elderly can in fact overcome their lack of digital skills and fears about using ICTs when a proper technical assistance is provided, as well social influence and cooperation between other students.

(ii) Improvement Recommendations for SmartAl Platform

The research developed, that included the literature review, visit to Altice Labs and a questionnaire to 142 elderly participants permitted to develop an overview and understanding of Health ICTs and the respective Use and Acceptance by the elderly population in order to achieve the project objective, provide improvement recommendations for Altice´ Health ICT solution, SmartAl-Smart Assisted Living".

Understand that providing the necessary assistance can make the difference for a good use, the first recommendation is to include a **Chat Assistance Service** inside the platform, with the possibility of using **videoconference or voice both technologies**, in alternative to traditional keyboards bottoms that the user need to click for writing for a more intuitive system. Additionally, also connected with the idea to provide facilitating tools for elderly to overcome their challenges, it could be interesting to include **multimedia content** as interactive beginner videos explaining how to use the platform.

Another improvement recommendation is about the dynamic of the platform itself, suggesting the implementation of a user gamification concept, rewarding with points if health tasks are completed and health improvements achieved. The literature analysis permitted to understand that ICTs should also have an entertainment interactivity with users for increasing continuous use and motivation, for a continuous use.

Understanding that the ageing process have direct impact in cognitive functions and in some cases leading to dementia, as Alzheimer or Parkinson, it is suggested to include **cognitive training games and brain tests** in the platform for stimulating memory and concentration and detect cases of early dementia. It is recommended that a health professional fallow the use of this solution and manage the improvements. Also understanding that elderly commonly face insomnia, sleep disorders and stress that leads to lead to depression, it would be useful to include **a sleep quality screening functionality**, using the smartphone interface or well-being questionnaires. Finally, the questionnaire permitted to evidence that even elderly didn't know about Cruz Vermelha Portuguese emergency bottom assistance service, they expressed it would be useful, recommending the connection of the platform with **smart bracelet or neck pendant** with an **emergency bottom** for alerting in case of fall or health emergency. Additionally, this bracelet could have a GPS tracker or a pedometer for promoting physic activity.

(iii) Study Limitations and Further Research Recommendations

For a proper understanding of the results presented in this project it is relevant to identify its limitations conditions, also motivating future investigations.

The sample collected is not sufficiently representative of the Portuguese elderly population, with limitations concerning demography as visited only urban areas, suggesting extending the research to rural and littoral zones as elderly living are distant of health centers.

Additionally, only had the opportunity to interview 9 users of health remote monitoring systems, limiting the possibility of understanding the implementation success of this solutions and users feedback. Due to information privacy legislation it was not possible for Altice to provide information relatively clients using SmartAl platform.

In order to avoid subjective interpretations and bias answers, confirmatory questions should have been used in the questionnaire, asking the same questions in different ways, confirming the consistency of answers, especially regarding ICTs use effort expectancy and concerns about Information Security and Privacy. In order to understand if Health ICTs are being useful it should have been interesting to extend the questionnaire also to caregivers and health professionals. In order to understand if Health ICTs are being useful it should have been interesting to extend the questionnaire also to caregivers.

For further investigations a longitudinal research would permit to compare the difference in terms of Use and Acceptance of Health ICTs between actual elderly participants and future generations that will be aged above 60 years old in the next 5 years, as well as analyze the Health ICTs innovations and a transversal research in different countries

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Appendix

1. List of Health Applications (Complement to Literature Review, Chapter 5.4)

Arthritis and Rheumatism	
ArthritisID	https://www.jointhealth.org/arthritisid.cfm?locale=en-CA
Health Log	https://play.google.com/store/apps/details?id=andrew.arproductions.healthlog&hl=en_US
RheumaHelper	https://rheumahelper.com/
Back to Action	https://itunes.apple.com/az/app/back-to-action/id470058141?mt=8v
Mobility Disabilities	
Microexpressions	https://play.google.com/store/apps/details?id=com.Mazuzu.ExpressionTraining&hl=en
Wheelmap	https://play.google.com/store/apps/details?id=org.wheelmap.android.online&hl=pt_PT
My DisabledGo London	https://www.accessable.co.uk/
Communication Disabilities	
HelpTalk	https://play.google.com/store/apps/details?id=com.helptalk&hl=pt
SmallTalk	https://itunes.apple.com/us/app/smalltalk-intensive-care/id403057381?mt=8
Talkforme	http://www.talkforme.ie/
Verbally	http://verballyapp.com/
Visual Impairment	
BIG Launcher	http://biglauncher.com/
Aira Vision Sim	https://itunes.apple.com/us/app/aira-vision-sim/id1276859786?mt=8
Cognitive Training	
Luminosity	https://www.lumosity.com/en/
BrainyApp	https://itunes.apple.com/us/app/brainyapp/id1084632021?mt=8
Elevateapp	https://www.elevateapp.com/
Brainwell	https://brainwell.com/
Alzheimer AlzNav	http://alznav.projects.fraunhofer.pt/
Brain Map	http://portal.brain-map.org/
Timeless	https://www.timeless.care
Asthma and Allergy	
MyAsthma	http://www.myasthma.com/
Pollenvarsel	https://itunes.apple.com/no/app/pollenvarsel/id506739051?mt=8
Sussex Air	https://play.google.com/store/apps/details?id=uk.org.londonair.sussex&hl=en_US
Anxiety, Stress and Insomnia	
Colour Therapy	https://itunes.apple.com/us/app/color-therapy-coloring-number/id1031002863?mt=8
Headspace	https://www.headspace.com/
Elevateapp	https://www.elevateapp.com/
Sleepcycle	https://www.sleepcycle.com/
Diabetes	
OnTrack Diabetes	https://play.google.com/store/apps/details?id=com.gexperts.ontrack&hl=pt_PT
Agamatrix	https://agamatrix.com/
Contournestone	http://www.contournextone.pt
Glucose Buddy Tracker	https://play.google.com/store/apps/details?id=com.skyhealth.glucosebuddyfree&hl=en
Cancer	
CancerAid	https://play.google.com/store/apps/details?id=au.com.canceraid
Wecancer	https://play.google.com/store/apps/details?id=com.wecancer.wecancer&hl=pt
Cancer Therapy Advisor	https://play.google.com/store/apps/details?id=com.usbmis.troposphere.chemad
Self-Care During Cancer	https://play.google.com/store/apps/details?id=com.nearspace.selfcare
Heart Monitoring	
Instant Heart Rate	https://play.google.com/store/apps/details?id=si.modula.android.instantheartrate&hl=en_US
iBP Blood Pressure	https://play.google.com/store/apps/details?id=com.leadingedgeapps.ibp&hl=en_US
Apple WatchOS 2.0 APP	https://pplware.sapo.pt/apple/apple-lanca-watchos-2-0/

Appendix Table 1 – mHealth Applications in Health Problems Management

Physical Training	
DailySeniorFitness	https://play.google.com/store/apps/details?id=com.ebmacs.dailyseniorfitnessexcercise&hl=en_US
Myfitnesspal	https://www.myfitnesspal.com/
Pocketyoga	http://www.pocketyoga.com/
Fooducate	https://www.fooducate.com/
Nutrition	
ShopWell	https://play.google.com/store/apps/details?id=com.shopwell.shopwellandroid&hl=pt_PT
Fooducate	https://play.google.com/store/apps/details?id=com.fooducate.nutritionapp&hl=pt_PT
CancerFightingFoods	https://play.google.com/store/apps/details?id=cancerfightingfoods.www.cancerfightingfoods
Alert in case of accident of emergency	
TeleAlarme	https://www.cruzvermelha.pt/sa%C3%BAde/%C3%A2mbito-nacional/teleassist%C3%AAncia.html
BHF Pocket CPR	https://www.imore.com/pocketcpr-app-british-heart-foundation-hits-app-store
First Aid CPR	https://www.mayoclinic.org/first-aid/first-aid-cpr/basics/art-20056600
112 Iceland	https://safetravel.is/112-iceland-app
Manage Medication / Fallow Doctors Instruction	
IBM Drug Ref	https://play.google.com/store/apps/details?id=com.truven.druginfonative.customer&hl=pt
Medisafe	https://play.google.com/store/apps/details?id=com.medisafe.android.client&hl=pt_PT
ProDoctor Medicamentos	https://play.google.com/store/apps/details?id=net.prodoctor.medicamentos&hl=pt_BR
Carezone	https://play.google.com/store/apps/details?id=com.carezone.caredroid.careapp.medications&hl=pt_PT
Book a Medical Appointment / Find a Doctor	
Hospitaldaluz	https://play.google.com/store/apps/details?id=pt.hospitaldaluz&hl=en
Joaquim Chaves Saúde	https://play.google.com/store/apps/details?id=gPatient.quadrantes.android
Doctoralia	https://www.doctoralia.com.pt/
ZocDoc	https://www.zocdoc.com/
Patient-Doctor Communication	
Medipal	https://play.google.com/store/apps/details?id=se.novatelligence.android&hl=en
Tonicapp	https://www.tonicapp.com/pt/
Self-Diagnosis / Online Medical Appointment	
Multicare Medicina Online	https://www.multicare.pt/PT/particulares/medicina-online/servicos/Paginas/medicina_online.aspx
WeMD	https://www.webmd.com/webmdapp3
iTriage	https://www.youtube.com/watch?v=_PTeOXSc6Bk
Pain Management	
Pain Diary	https://play.google.com/store/apps/details?id=com.sanovation.catchmypain.pro
Febre-i-dor	http://www.febre-i-dor.pt/#o-que-e
Access National Health Digital Services	
MySNS	https://www.sns.gov.pt/2016/09/15/mysns-a-app-para-o-cidadao/
MaisSaúdeCidadão	https://play.google.com/store/apps/details?id=br.inf.ids.maissaudecidadaoc

Appendix Table 2 – mHealth Applications for General Elderly Healthcare Management

2. Questionnaire Guideline (in Portuguese)

Questionário: Uso e Aceitação das Tecnologias de Informação de Comunicação (TICs) na Saúde por parte da População Idosa em Portugal

Com o presente questionário pretende-se analisar o Uso e Aceitação das **tecnologias de informação e comunicação (TICs)** na gestão da saúde por parte da população com 60 ou mais anos de idade.

Os resultados serão usados apenas para fins académicos (tese de mestrado), garantindo-se o anonimato e total confidencialidade das respostas. Não existem respostas certas ou erradas, sendo solicitado que responda às questões com sinceridade, permitindo aferir as melhores conclusões. Este questionário é composto por 15 questões, com um tempo médio de duração de 7 minutos. Obrigado pela colaboração.

Estrutura do Questionário:

GRUPO A	**Informação Pessoal**		**5 Questões**	
GRUPO B Uso das TIC	**PARTE I**	Compreender se já usa TICs	1 Questão	**5 Questões**
	PARTE II	Uso das TICs na Saúde	3 Questões	
GRUPO C Aceitação das TICs	**PARTE I**	Percepção pessoal do Estado de Saúde	1 Questão	**6 Questões**
	PARTE II	Aceitação das TICs na Gestão da Saúde	5 Questões	

TOTAL
16 Questões

Data do Questionário:

GRUPO A : Informação Pessoal

A.1	Idade?
A.2	Género?

A.3	Onde vive e com quem? **A)** Casa própria c/ Cônjugue ☐ **B)** casa própria c/ Filhos ☐ **C)** Sozinho ☐ **D)** Lar ☐ **E)** Outra Opção (Especifique) ☐

A.4 Educação	Nível de Educação? **A)** Ensino Básico ☐ **B)** Curso Técnico ☐* **C)** Licenciatura ☐* **D)** Mestrado, Doutoramento.. ☐*

* especifique a àrea de estudo

A.5 Profissão	Ocupação Atual? **A)** Trabalhador Dependente ☐ **B)** Trabalhador Independente ☐ **C)** Desempregado ☐ **D)** Reformado ☐ Profissão atual/antiga?

GRUPO B : Uso das TICs

PARTE I - Compreender se já usa alguma TICs

		Já usou algumas das seguintes tecnologias de informação e comunicação (TICs)?	1) **Não**	2) **Sim**, todos os Dias	3) **Sim**, mas não todos os dias	4) **Sim**, mas raramente
B.1	**A)**	Telefone por cabo	☐	☐	☐	☐
	B) ou **C)**	Telemóvel, sem ligação à internet	☐	☐	☐	☐
		Telemóvel, com ligação à internet (Smart Phone)	☐	☐	☐	☐
	D)	Televisão	☐	☐	☐	☐
	E)	Internet	☐	☐	☐	☐
	F)	Computador	☐	☐	☐	☐
	G)	Tablet	☐	☐	☐	☐
	H)	Outras, quais?	☐	☐	☐	☐

PARTE II - Uso das TICs na Saúde

		Relativamente às seguintes TICs na saúde, qual é que usa e com que frequência?
B.2	A)	Sistemas de monitorização ☐*
	B)	Saúde 24 (808 242424) ☐*
	C)	Teleassistência (botão de emergência) ☐*
	D)	Apps de Saúde no telemóvel ☐*
	E)	Internet / Websites Saúde ☐*
	F)	Outra TICs de saúde (Qual?) ☐*

* com que Frequência?

	Selecione as razões para nunca ter usado algumas destas TICs na saúde?			
B.3	1) Pouco interesse em usar Tecnologias	☐	2) Não Tenho necessidade de Saúde	☐
	3) Incapacidade física ou cognitiva	☐	4) Desconhecia estas Tecnologias	☐
	5) Prefere relação Pessoal com o médico	☐	6) Outras Razões ☐*Quais?	

Se nunca usou TICs na saúde, passar ao Grupo B

		Avaliação Negativa - Avaliação Positiva				
B.4	No geral, como avalia as tecnologias de informação e comunicação da Saúde que usa? (1 a 5)	1	2	3	4	5
		☐	☐	☐	☐	☐

		Relativamente às <u>TICs na Saúde que usa</u>, indique o grau com o qual concorda com as seguintes afirmações	**Não** Aplicável	Desacordo Totalmente - Concordo Totalmente				
				1	2	3	4	5
B.5	A)	As Tecnologias de Informação e Comunicação da saúde que uso trouxeram benefícios na gestão da minha saúde	☐	☐	☐	☐	☐	☐
	B)	As Tecnologias de Informação e Comunicação que uso são intuitivas e estão adaptadas às minhas capacidades	☐	☐	☐	☐	☐	☐
	C)	Tenho acesso a assistência em caso de dificuldade a usar as tecnologias na saúde	☐	☐	☐	☐	☐	☐
	D)	Consigo adquirir as tecnologias de informação e comunicação que necessito na gestão da minha saúde	☐	☐	☐	☐	☐	☐

GRUPO C : Aceitação das TICs (em geral)

PARTE I - Percepção pessoal do Estado de Saúde

		Pouco Saudável - Muito Saúdavel				
C.1	De 1 a 5, Como avalia o seu estado de saúde?	1	2	3	4	5
		☐	☐	☐	☐	☐

Parte II - Aceitação das TICs na Gestão da Saúde

Indique o grau com o qual concorda com as seguintes afirmações:			**Não** Aplicável	**Desacordo Totalmente - Concordo Totalmente**				
				1	2	3	4	5
C.4	A)	Acredito que as tecnologias de Informação e comunicação podem melhorar a gestão da saúde	☐	☐	☐	☐	☐	☐
	B)	Seria útil para mim usar Tecnologias de Informação e Comunicação na gestão da minha saúde	☐	☐	☐	☐	☐	☐
	C)	Será fácil para mim usar tecnologias de informação e comunicação na gestão da minha Saúde	☐	☐	☐	☐	☐	☐
	D)	As pessoas importantes para mim apoiam que eu use tecnologias de informação e comunicação na gestão da minha saúde	☐	☐	☐	☐	☐	☐
	E)	As tecnologias de Informação e comunicação garantem a privacidade e segurança da informação	☐	☐	☐	☐	☐	☐

	Que tipo de TICs estaria interessado em usar?
C.6	A) Monitorização Sinais Vitais em Casa ☐ B) TeleAlarme Emergência ☐ C) TeleConsulta ☐ D) Marcar a consulta na Internet ☐ E) Programa Treino Cognitivo ☐ F) SmartWatch ☐ G)Outra TICs ☐* Quais?

	Que tipo de App de Saúde estaria interessado em usar? (em caso de já usar Smartphone)
C.7	A) MySNS/ Saúde Cidadão ☐ B) Gerir Medicação/Tratamentos ☐ C) Gerir Doenças Crónicas ☐ D) Treino Cognitivo ☐ E) Gestão Sono e Stress ☐ F) Desporto e Nutrição ☐ G)Outras Apps ☐ * Quais?

3. Analysis Outputs: IBM SPSS

A. Telephone Use

		A.1.Age Range				
		60-70(included)	70-80(included)	80-90(included)	Over 90	Total
Telephone	1	10	5	3	0	18
	2	13	22	30	4	69
	3	29	16	10	0	55
Total		52	52	43	43	4

Appendix Table 3 – Crosstabulation: Telephone Use and Age Range

		A.3.Living With				
		Alone	Elderly Home	Family	Partner	Total
Telephone	1	4	0	4	10	18
	2	26	11	9	23	69
	3	13	6	5	31	55
Total		43	43	17	18	64

Appendix Table 4 – Crosstabulation: Telephone Use and Living with

		A.4.Education Level				
		Academic	Basic Education	High School	Technical Course	Total
Telephone	1	4	10	3	1	18
	2	5	48	8	8	69
	3	20	14	7	14	55
Total		29	72	18	23	23

Appendix Table 5 – Crosstabulation: Telephone Use and Education Level

B. Simple Phone Use

		A.1.Age Range				
		60-70(included)	70-80(included)	80-90(included)	Over 90	Total
Simple Mobile Phone	1	47	30	23	2	102
	2	5	12	18	2	37
	3	0	1	2	0	3
Total		52	52	43	43	4

Appendix Table 6 – Crosstabulation: Simple Mobile Phone Use and Age Range

		A.2.Gender		
		Female	Male	Total
Simple Mobile Phone	1	64	38	102
	2	14	23	37
	3	1	2	3
Total		79	63	142

Appendix Table 7 – Crosstabulation: Simple Mobile Phone Use and Gender

		A.3.Residence			
		Lisboa	Other	Setubal	Total
Simple Mobile Phone	1	50	30	22	102
	2	24	5	8	37
	3	3	0	0	3
Total		77	35	30	142

Appendix Table 8 – Crosstabulation: Simple Mobile Phone Use and Residence

		A.3.Living With				
		Alone	Elderly Home	Family	Partner	Total
Simple Mobile Phone	1	28	13	15	46	102
	2	14	3	3	17	37
	3	1	1	0	1	3
Total		43	17	18	64	142

Appendix Table 9 – Crosstabulation: Simple Mobile Phone Use and Living With

		A.4.Education Level				
		Academic	Basic Education	High School	Technical Course	Total
Simple Mobile Phone	1	24	47	15	16	102
	2	5	24	3	5	37
	3	0	1	0	2	3
Total		29	72	18	23	142

Appendix Table 10 – Crosstabulation: Simple Mobile Phone Use and Education

		A.4.Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Simple Mobile Phone	1	9	10	3	18	6	18	36	102
	2	4	2	0	10	3	4	14	37
	3	0	0	0	2	0	0	1	3
Total		13	12	3	30	9	22	51	142

Appendix Table 11 – Crosstabulation: Simple Mobile Phone Use and Profession

		A.4.Occupation				
		Employed	Independent Worker	Retired	Unemployed	Total
Simple Mobile Phone	1	10	4	87	1	102
	2	1	0	36	0	37
	3	0	0	3	0	3
Total		11	4	126	1	142

Appendix Table 12 – Crosstabulation: Simple Mobile phone Use and Occupation

C. Smartphone

		A.1.Age Range				
		60-70(included)	70-80(included)	80-90(included)	Over 90	Total
Smartphone	1	6	18	41(95,3%)	4 (100%)	69
	2	46 (88,5%)	25 (58,2%)	2	0	73
Total		52	43	43	4	142

Appendix Table 13 – Crosstabulation: Smartphone Use and Age Range

		A.2.Gender		
		Female	Male	Total
Smartphone	1	29	40 (63,5%)	69
	2	50 (63,3%)	23 (36%)	73
Total		79	63	142
				% within Gender

Appendix Table 14 – Crosstabulation: Smartphone Use and Gender

		A.3.Living With				
		Alone	Elderly Home	Family	Partner	Total
Smartphone	1	21	15(88,3%)	7	26	69
	2	22	2	11 (61%)	38 (59,4%)	73
Total		43	17	18	64	142

Appendix Table 15 – Crosstabulation: Smartphone Use and Living With

		A.4.Education Level				
		Academic	Basic Education	High School	Technical Course	Total
Smartphone	1	7	46(63,9%)	6	10	69
	2	22 (75,8)	26 (36,1%)	12(66,6%)	13(56,5%)	73
Total		29	72	18	23	142

Appendix Table 16 – Crosstabulation: Smartphone Use and Education Level

		A.4.Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Smartphone	1	6	3	1	16	4	12	25	69
	2	7	9(75%)	2	14	5 (55%)	10	26	73
Total		13	12	3	30	9	22	51	142

Appendix Table 17 – Crosstabulation: Smartphone Use and Type of profession

Television

		A.1.Age Range				
		60-70(included)	70-80(included)	80-90(included)	Over 90	Total
Television	1	6	2	1	0	9
	2	30	32	39	3	104
	3	16	9	3	1	29
Total		52	43	43	4	142

Appendix Table 18 – Crosstabulation: Television Use and Age Range

		A.2.Gender		
		Female	Male	Total
Television	1	1	8	9
	2	58(73,4%)	46 (73%)	104
	3	20	9	29
Total		79	63	142

Appendix Table 19 – Crosstabulation: Television Use and Gender

		A.3.Residence			
		Lisboa	Other	Setubal	Total
Television	1	2	2	5	9
	2	60 (77,9%)	26 (74,3%)	18 (60%)	104
	3	15	7	7	29
Total		77	35	30	142

Appendix Table 20 – Crosstabulation: Television Use and Residence

		A.3.Living With				
		Alone	Elderly Home	Family	Partner	Total
Television	1	1	0	1	7	9
	2	39 (90,7)	16 (94%)	11 (61%)	38 (59,37%)	104
	3	3	1	6	19 (29,7%)	29
Total		43	17	18	64	142

Appendix Table 21 – Crosstabulation: Television Use and Living With

		A.4.Occupation				
		Employed	Independent Worker	Retired	Unemployed	Total
Television	1	2 (18%)	0	7	0	9
	2	4	4	95 (75,4%)	1	104
	3	5 (45,5%)	0	24 (19%)	0	29
Total		11	4	126	1	142

Appendix Table 22 – Crosstabulation: Television Use and Occupation

D. Computer

		A.1.Age Range				
		60-70(included)	70-80(included)	80-90(included)	Over 90	Total
Computer	1	9	23 (53,5%)	39 (90.7%)	4(100%)	75
	2	27 (51,9%)	13 (30,2%)	2	0	42
	3	16 (30,7%)	7	2	0	25
Total		52	43	43	4	142

Appendix Table 23 – Crosstabulation: Computer Use and Age Range

		A.2.Gender		
		Female	Male	Total
Computer	1	37 (47%)	38 (60%)	75
	2	25 (32%)	17 (27%)	42
	3	17	8	25
Total		79	63	142

Appendix Table 24 – Crosstabulation: Computer Use and Gender

		A.3.Residence			
		Lisboa	Other	Setubal	Total
Computer	1	52 (67,5%)	14	9	75
	2	15 (19,4%)	13 (37,2%)	14 (46%)	42
	3	10	8	7	25
Total		77	35	30	142

Appendix Table 25 – Crosstabulation: Computer Use and Residence

		A.3.Living With				
		Alone	Elderly Home	Family	Partner	Total
Computer	1	27 (63%)	12 (70%)	8 (44,4%)	28 (43%)	75
	2	7 (16,3%)	3 (17,6%)	7 (38%)	25 (40%)	42
	3	9	2	3 (16,6%)	11 (17%)	25
Total		43	17	18	64	142

Appendix Table 26 – Crosstabulation: Computer Use and Living With

		A.4.Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Computer	1	4	53 (73,6%)	7	11	75
	2	17 (58,6%)	8 (11,11%)	6	11	42
	3	8	11	5	1	25
Total		29	72	18	23	142

Appendix Table 27 – Crosstabulation: Computer Use and Education

		A.4.Type of Profession							Total
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	
Computer	1	6	5	2	18 (60%)	5	11 (50%)	26(51%)	75
	2	4	2	1	6(20%)	4 (44%)	9 (41%)	17 (33,3%)	42
	3	3	5	0	6	0	2	8	25
Total		13	12	3	30	9	22	51	51

Appendix Table 28 – Crosstabulation: Computer Use and Profession

		A.4.Occupation				Total
		Employed	Independent Worker	Retired	Unemployed	
Computer	1	4	1	70 (55,5%)	0	75
	2	6 (54,5%)	3 (75%)	33 (26%)	0	42
	3	1	0	23	1	25
Total		11	4	126	1	142

Appendix Table 29 - Crosstabulation: Computer Use and Occupation

F. Tablet

		A.1.Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Tablet	1	29 (55,7%)	35(81,4%)	42	4 (100%)	110
	2	21 (40,4%)	5 (11,6%)	0 (0%)	0 (0%)	26
	3	2	3	1	0	6
Total		52	43	43	4	142

Appendix Table 30 – Crosstabulation: Tablet Use and Age Range

		A.2.Gender		Total
		Female	Male	
Tablet	1	53 (67%)	57 (90,5%)	110
	2	22 (27,8%)	4 (6%)	26
	3	4	2	6
Total		79	63	142

Appendix Table 31 – Crosstabulation: Tablet Use and Gender

		A.3.Residence			Total
		Lisboa	Other	Setubal	
Tablet	1	65 (84%)	25 (71,4%)	20 (66,6%)	110
	2	10 (13%)	9 (25,7%)	7 (23%)	26
	3	2	1	3	6
Total		77	35	30	142

Appendix Table 32 – Crosstabulation: Tablet Use and Residence

		A.3.Living With				
		Alone	Elderly Home	Family	Partner	Total
Tablet	1	37 (86%)	16 (94%)	11 (61%)	46	110
	2	5	1	5 (27%)	15 (23,4%)	26
	3	1	0	2	3	6
Total		43	17	18	64	142

Appendix Table 33 – Crosstabulation: Tablet Use and Living With

		A.4.Education Level				
		Academic	Basic Education	High School	Technical Course	Total
Tablet	1	17 (58,6%)	63 (87,5%)	13 (72%)	17 (74%)	110
	2	11 (38%)	5 (7%)	4 (22%)	6 (26%)	26
	3	1	4	1	0	6
Total		29	72	18	23	142

Appendix Table 34 – Crosstabulation: Tablet Use and Education

		A.4.Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Tablet	1	9	7	2	24 (80%)	6	16	43 (84%)	110
	2	4 (31%)	1	1	6 (20%)	3 (33%)	5 (23%)	7 (13%)	26
	3	0	4	0	0	0	1	1	6
Total		13	12	3	30	9	22	51	142

Appendix Table 35 – Crosstabulation: Tablet Use and Profession

		A.4.Occupation				
		Employed	Independent Worker	Retired	Unemployed	Total
Tablet	1	8	2	99	1	110
	2	2 (18%)	1 (25%)	23 (18%)	0	26
	3	1	1	4	0	6
Total		11	4	126 (88,7%)	1	142

Appendix Table 36 – Crosstabulation: Tablet Use and Profession

Acceptance of Health ICTs (Likert Scale)

A. Acceptance Evaluation

		Age Range				
		60-70(included)	70-80(included)	80-90(included)	Over 90	Total
Acceptance	1	9	4	25 (64,1%)	1	39
	2	1	2	5	1	9
	3	7	5	3	0	15
	4	20 (38.5%)	17 (37.8%)	7	1	45
	5	15 (44.1%)	15 (44.1%)	3	1	34
Total		52	43	43	4	142

Appendix Table 37 – Crosstabulation: Acceptance Evaluation and Occupation

		Gender		Total
		Female	Male	
Acceptance	1	16	23 (59.0%)	39
	2	4	5	9
	3	9	6	15
	4	26	19	45
	5	24 (70.6%)	10	34
Total		79	63	142

Appendix Table 38 – Crosstabulation: Acceptance Evaluation and Gender

		Health Condition			Total
		2	3	4	
Acceptance	1	2	18	19 (48.7%)	39
	2	1	3	5 (55.6%)	9
	3	2	3	10 (66.7%	15
	4	7	21	17	45
	5	8	10	16	34
Total		20	55	67	142

Appendix Table 39 – Crosstabulation: Acceptance Evaluation and Health Condition

		A.3.Living With				Total
		Alone	Elderly Home	Family	Partner	
Acceptance	1	11	8	4	16	39
	2	3	2	1	3	9
	3	4	2	2	7	15
	4	14	5	7	19	45
	5	11 (32.4%)	0	4	19 (55.9%)	34
Total		43	17	18	64	142

Appendix Table 40 – Crosstabulation: Acceptance Evaluation and Living With

		Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Acceptance	1	5	24 (61.5%)	5	5	39
	2	2	6 (66.7%)	0	1	9
	3	2	8	2	3	15
	4	11 (24.4%)	20	8	6	45
	5	9 (31.0%)	14	3	8	34
Total		29	72	18	23	142

Appendix Table 41 – Crosstabulation: Acceptance Evaluation and Education

		A.4.Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Acceptance	1	2	4	1	7	1	5	19	39
	2	0	0	0	1	0	3	5	9
	3	1	1	0	1	1	3	8	15
	4	6	3	1	9	5	8	13	45
	5	4	4	1	12	4	3	6	34
Total		13	12	3	30	11	22	51	142

Appendix Table 42 – Crosstabulation: Acceptance Evaluation and Profession

		Profile User				Total
		0	1	2	3	
Acceptance	1	35	3	1	0	39
	2	9	0	0	0	9
	3	4	8	3	0	15
	4	18(24.7%*)	16(38.1%*)	9(40.9%*)	2(40.0%*)	45
	5	7(9.6%*)	15(35.7%*)	9(40.9%*)	3(60.0%*)	34
Total		73(100%)	42	22	5	142

*% within Profile User

Appendix Table 43 – Crosstabulation: Acceptance Evaluation and Profile User

B. Usefulness Expectancy

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Usefulness Expectancy	1	9	2	23 (53.5%*)	1 (25.0%*)	35
	2	2	4	14.0% (14.0%*)	1 (25.0%*)	13
	3	7	2	3	1	13
	4	20 (38.5%*)	25 (58.1%*)	8	1	54
	5	14 (26.9%*)	10 (23.3%*)	3	0	27
Total		52 (100%)	43	43	4	142

*% within Age Range

Appendix Table 44 – Crosstabulation: Usefulness Expectancy and Age Range

		Gender		Total
		Female	Male	
Usefulness Expectancy	1	13 (16.5%)	22 (62.9%*)	35
	2	7	6	13
	3	9	4	13
	4	30 (21.1%*)	24 (16.9%)	54
	5	20 (25.3%*)	7 (11.1%)	27
Total		79 (100%)	63	142

*% within Age Range

Appendix Table 45 – Crosstabulation: Usefulness Expectancy and Gender

		Health Condition			Total
		2	3	4	
Usefulness Expectancy	1	1	15	19 (28.4%*) (54.3%**)	35
	2	1	6	6	13
	3	2	2	9	13
	4	7 (35.0%)	24	23 (34.3%*)	54
	5	9 (45.0%)	8	10 (14.9%*)	27
Total		20	55	67	142

* % within Health Condition ** % within Usefulness Expectancy

Appendix Table 46 – Crosstabulation: Usefulness Expectancy and Health Condition

		Living With				Total
		Alone	Elderly Home	Family	Partner	
Usefulness Expectancy	1	9	7	4	15 (23.4%*)	35
	2	5	2	2	4 (6.3%*)	13
	3	2	3	3	5	13
	4	17 (39.5%*)	5 (29.4%*)	5 (27.8%*)	27 (42.2%*)	54
	5	10 (23.3%*)	0	4 (22.2%*)	13 (20.3%*)	27
Total		43	17	18	64	142

* % within Health Condition

Appendix Table 47 – Crosstabulation: Usefulness Expectancy and Living With

		Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Usefulness Expectancy	1	4 (13.8%)	22 (30.6%)	5	4	35
	2	3	7	1	2	13
	3	2	5	2	4	13
	4	13 (44.8%)	27 (37.5%	5	9	54
	5	7(24.1%)	11 (15.3%)	5	4	27
Total		29	72	18	23	142

* % within Health Condition

Appendix Table 48 – Crosstabulation: Usefulness Expectancy and Education Level

		A.4.Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Usefulness Expectancy	1	1	4	1	7	1	4	17	35
	2	1	0	0	1	1	4	6	13
	3	1	1	0	2	1	4	4	13
	4	5 (38.5%)	5 (41.7%)	2 (66.7%)	11 (36.7%)	6 (54.5%)	8 (36.4%)	17 (33.3%)	54
	5	5 (38.5%)	2 (16.7%)	0 (0.0%)	9 (30%)	2 (18.2%)	2 (9.1%)	7 (13.7%)	27
Total		13	12	3	30	11	22	51	142

* % within Type of Profession

Appendix Table 49 – Crosstabulation: Usefulness Expectancy and Profession

C. Effort Expectancy

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Effort Expectancy	1	10	5	27 (62.8%)	1	43
	2	3	2	3 (7.0%)	1	9
	3	25	23	7	2	57
	4	14 (26.9%)	13 (30.2%)	6	0	33
Total		52	43	43	4	142

% within Age Range

Appendix Table 50 – Crosstabulation: Effort Expectancy and Age Range

		Gender		Total
		Female	Male	
Effort Expectancy	1	17 (21.5%)	26 (41.3%)	43
	2	5	4	9
	3	36	21	57
	4	21 (26.6%)	12 (19.0%)	33
Total		79	63	142

% within Gender

Appendix Table 51 – Crosstabulation: Effort Expectancy and Gender

		Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Effort Expectancy	1	6 (20.7%)	27 (37.5%)	4 (22.2%)	6 (26.1%)	43
	2	2	3	2	2	9
	3	12 (41.4%)	30 (41.7%)	5	10	57
	4	9 (31.0%)	12 (16.7%)	7	5	33
Total		29	72	18	23	142

% within Education Level

Appendix Table 52 – Crosstabulation: Effort Expectancy and Education

		Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Effort Expectancy	1	2	4	1	8	0	8	20	43
	2	0	0	0	0	2	3	4	9
	3	6	3	1	10	5	8	24	57
	4	5	5	1	12	4	3	3	33
Total		13	12	3	30	11	22	51	142

* % within Type of Profession

Appendix Table 53 – Crosstabulation: Effort Expectancy and Profession

		Profile User				Total
		0 (Not Use)	1 (Basic)	2 (Intermediate)	3 (Advanced)	
Effort Expectancy	1	38 (52.1%)	4 (9.5%)	1 (4.5%)	0	43
	2	4	4	1	0	9
	3	24 (32.9%)	18	13	2	57
	4	7 (9.6%)	16 (38.1%)	7 (31.8%)	3 (60.0%)	33
Total		73	42	22	5	142
						*% within Profile User

Appendix Table 54 – Crosstabulation: Effort Expectancy and Profile User

C. Social Influence

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Social Influence	1	8	9	23 (53.5%)	2	42
	2	9	8	6	0	23
	3	4	1	7	0	12
	4	17 (32.7%)	13 (30.2%)	5 (11.6%)	2	37
	5	14 (26.9%)	12 (26.9%)	2 (4.7%)	0	28
Total		52	43	43	4	142
						% within Age Range

Appendix Table 55 – Crosstabulation: Social Influence and Age Range

		Gender		Total
		Female	Male	
Social Influence	1	17 (21.5%)	25 (39.7%)	42
	2	13 (16.5%)	10 (15.9%)	23
	3	7	5	12
	4	22 (27.8%)	15 (26.1%)	37
	5	20 (25.3%)	8 (12.7%)	28
Total		79	63	142
				% within Gender

Appendix Table 56 – Crosstabulation: Social Influence and Gender

		A.3.Living With				Total
		Alone	Elderly Home	Family	Partner	
Social Influence	1	16 (37.2%)	5 (29.4%)	5 (27.8%)	16 (25.0%)	42
	2	11	1	0	11	23
	3	2	5	3	2	12
	4	8	5	8	16	37
	5	6	1	2	19	28
Total		43	17	18	64	142
						* % within Living With

Appendix Table 57 – Crosstabulation: Social Influence and Living With

D. Information Security and Privacy

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Information Security and Privacy	1	8	1	12	0	21
	2	26	27	27	3	83
	3	11	11	3	1	26
	4	7	4	1	0	12
Total		52	43	43	4	142

Appendix Table 58 – Crosstabulation: Information Security and Privacy and Age Range

		Gender		Total
		Female	Male	
Information Security and Privacy	1	10	11	21
	2	49 (59.0%)	34 (41.0%)	83
	3	13	13	26
	4	7	5	12
Total		79	63	142
				% withing Gender

Appendix Table 59 – Crosstabulation: Information Security and Privacy and Gender

		Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Information Security and Privacy	1	3 (10.3%)	14 (19.4%)	1 (5.6%)	13.0% (13.0%	21
	2	11 (37.9%)	47 (65.3%)	13 (72.2%)	12 (52.2%)	83
	3	10	8	3	5	26
	4	5	3	1	3	12
Total		29	72	18	23	142
						% Education Level

Appendix Table 60 – Crosstabulation: Information Security and Privacy and Education

Use of Health ICTs (Likert Scale)

A. Health Benefit

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Perception of Health Benefit (users)	2	2	2	0	0	4
	3	6	9	1	0	16
	4	17 (80%)	2	2	0	21
	5	14 (58%)	8	2	0	24
Total		39	21	5	0	65
Not users		13	22	38	4	77
Total		52	43	43	4	142
						% within Perception of Health Benefit

Appendix Table 61 – Crosstabulation: Health Benefit and Age Range

		Gender		Total
		Female	Male	
Perception of Health Benefit (users)	2	2	2	4
	3	11	5	16
	4	14	7	21
	5	17 (21.5%*) (70%**)	7 (11.1%*)	24
Total		44	21	65
Not users		35 (44.3%*)	42 (66.7%*)	77
Total		79	63	142

*% within Gender **% within perception of health benefit

Appendix Table 62 – Crosstabulation: Health Benefit and Gender

		Health Condition			Total
		2	3	4	
Perception of Health Benefit	2	1	1	2	4
	3	4	5	7	16
	4	5 (31%)	7	9	21
	5	6 (37.5%)	9	9	24
	Not users	4	33 (42%**)	40 (52%**)	77
Total		20	55	67	142

* % within Health Condition ** % within Usefulness Expectancy

Appendix Table 63 – Crosstabulation: Health Benefit and Health Condition

		A.3.Living With				Total
		Alone	Elderly Home	Family	Partner	
Perception of Health Benefit	2	2	0	0	2	4
	3	5	1	3	7	16
	4	3	1	6	11	21
	5	9 (47%)	1 (33.3%)	2 (18.2%)	12 (37.5%)	24
	Not users	24	14	7	32	77
Total		43	17	18	64	142

* % within Living With

Appendix Table 64 – Crosstabulation: Health Benefit and Living With

B. Usability Evaluation

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Usability Evaluation (users)	2	1	4	1	0	6
	3	10	5	0	0	15
	4	21	7	2	0	30
	5	7	5	2	0	14
Not users		13	22	38	4	77
Total		52	43	43	4	142

Appendix Table 65 – Crosstabulation: Usability and Age Range

		Gender		Total
		Female	Male	
Usability Evaluation (users)	2	3	3	6
	3	12	3	15
	4	20	10	30
	5	9	5	14
Not users		35	42	77
Total		79	63	142

Appendix Table 66 – Crosstabulation: Usability and Gender

		Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Usability Evaluation (users)	2	2	3	1	0	6
	3	2	4	4	5	15
	4	9 (50%)	13 (54.16%)	5	3	30
	5	5	4	0	5	14
	Not users	11	48	8	10	77
Total		29	72	18	23	142

* % within Education Level

Appendix Table 67 – Crosstabulation: Usability and Education Level

		A.4.Type of Profession							Total
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	
Usability Evaluation (users)	2	1	1	0	0	0	1	3	6
	3	1	0	1	4	1	3	5	15
	4	6	6	0	8 (47%*)	3	3 (42%*)	4	30
	5	1	0	0	5 (29%*)	1	1 (14%*)	6	14
Total		13	12	3	30	11	22	51	142

* % within Type of Profession

Appendix Table 68 – Crosstabulation: Usability and Profession

		Profile User				Total
		0	1	2	3	
Usability Evaluation (users)	2	0	5	0	1	6
	3	0	10	5	0	15
	4	0	14	13	3	30
	5	0	10	3	1	14
Total		73	42	22	5	142

Appendix Table 69 – Crosstabulation: Usability and Profile User

C. Access to Assistance

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Assistance (users)	2	6	8	2	0	16
	3	13	7	1	0	21
	4	15 (28.8%)	3 (7.0%)	2 (4.7%)	0	20
	5	5 (9.6%)	3 (7.0%)	0	0	8
Not users		13	22	38	4	77
Total		52	43	43	4	142

Appendix Table 70 – Crosstabulation: Access to Assistance and Age Range

		Gender		Total
		Female	Male	
Assistance (users)	2	11 (13.9%)	5 (7.9%)	16
	3	16 (20.3%)	5 (7.9%)	21
	4	10 (12.7%)	10 (15.9%)	20
	5	7 (8.9%)	1 (1.6%)	8
Not users		35	42	77
Total		79	63	142

*%within Gender

Appendix Table 71 – Crosstabulation: Access to Assistance and Gender

		A.3.Living With				Total
		Alone	Elderly Home	Family	Partner	
Assistance (users)	2	7 (16.3%*)	0	2	7 (10.9%*)	16
	3	4	2	5	10	21
	4	6 (14.0%*)	1	2 (11.1%)	11 (17.2%*)	20
	5	2	0	2 (11.1%)	4(6.3%*)	8
	Not users	24	14	7	32	77
Total		43	17	18	64	142

* % within Living With

Appendix Table 72 – Crosstabulation: Access to Assistance and Living With

D. Access to Health ICTs

		Age Range				Total
		60-70(included)	70-80(included)	80-90(included)	Over 90	
Access to Health ICTs	2	2	5	0	0	7
	3	16	6	1	0	23
	4	18	7	3	0	28
	5	3	3	1	0	7
Total		39	21	5	0	65

Appendix Table 73 – Crosstabulation: Access to Health ICTs and Age Range

		Gender		Total
		Female	Male	
Access to Health ICTs	2	2	5	7
	3	18	5	23
	4	20 (71.4%)	8 (38%)	28
	5	4	3	7
Total		44	21	65
				%within Gender

Appendix Table 74 – Crosstabulation: Access to Health ICTs and Gender

		Education Level				Total
		Academic	Basic Education	High School	Technical Course	
Access to Health ICTs	2	4	1	2	0	7
	3	2	10	4	7	23
	4	7	13	3	5	28
	5	5 (27.7%)	0	1	1	7
Total		18	24	10	13	65
						* % within Education Level

Appendix Table 75 – Crosstabulation: Access to Health ICTs and Education Level

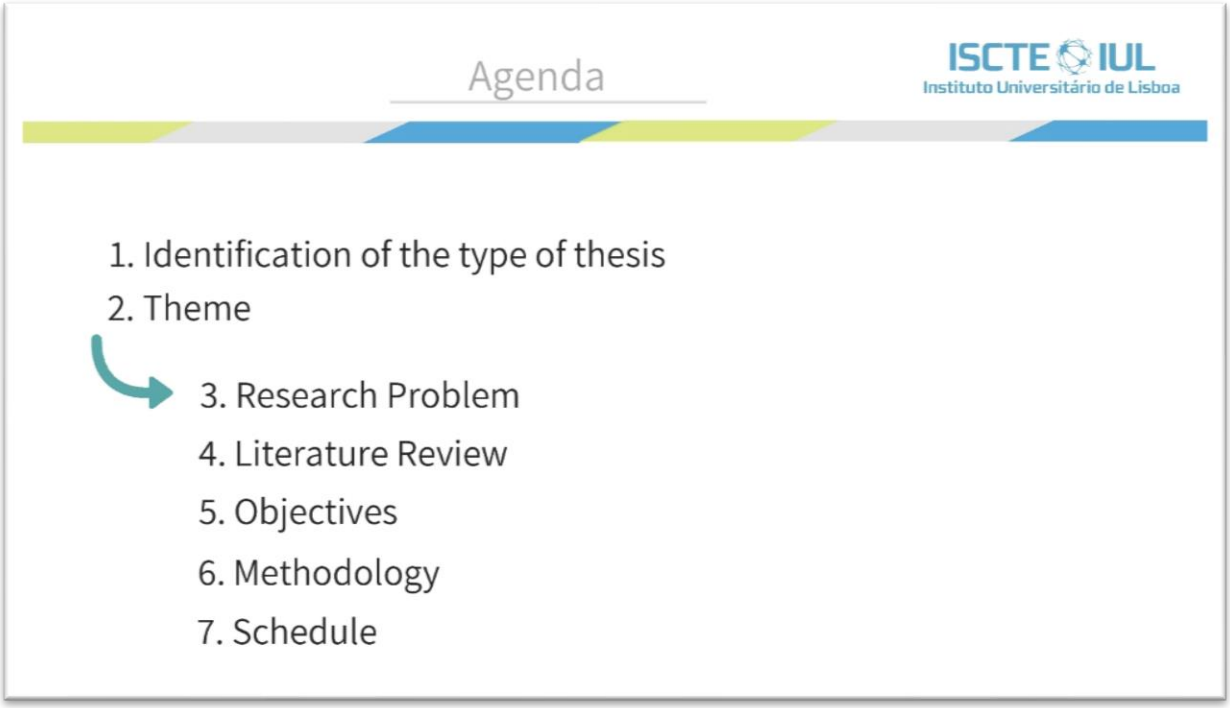
		A.4.Type of Profession							
		Domestic	Health Professionals	Independent Business Owner	Not Qualified	Professor and Intellectual Profession	Qualified	Technical	Total
Access to Health ICTs	2	1	0	0	0	1	1	4	7
	3	2	1	1	6	2	5	6	23
	4	5	6	0	8	2	2	5	28
	5	1	0	0	3	0	0	3	7
Total		9	7	1	17	5	8	18	65
									* % within Type of Profession

Appendix Table 76 – Crosstabulation: Access to Health ICTs and Type of Profession

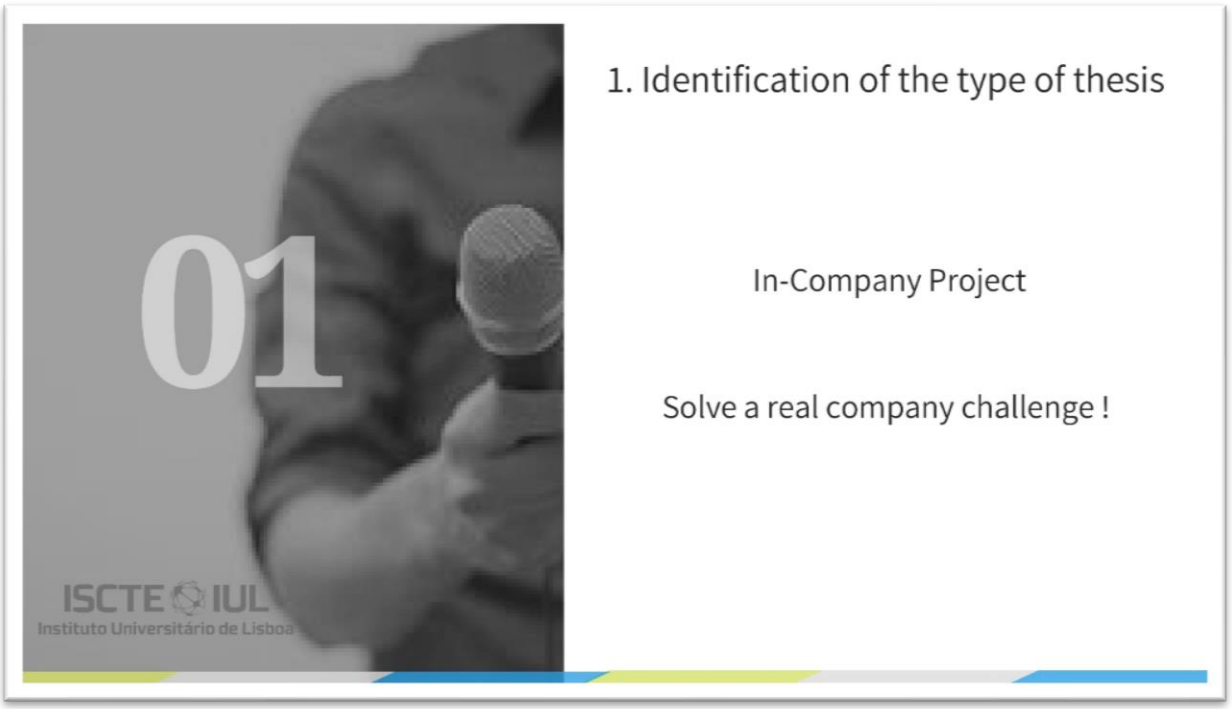
4. Presentation Slides: 1º Meeting with Altice Foundation (September 2019)

(Slide 1)

(Slide 2)



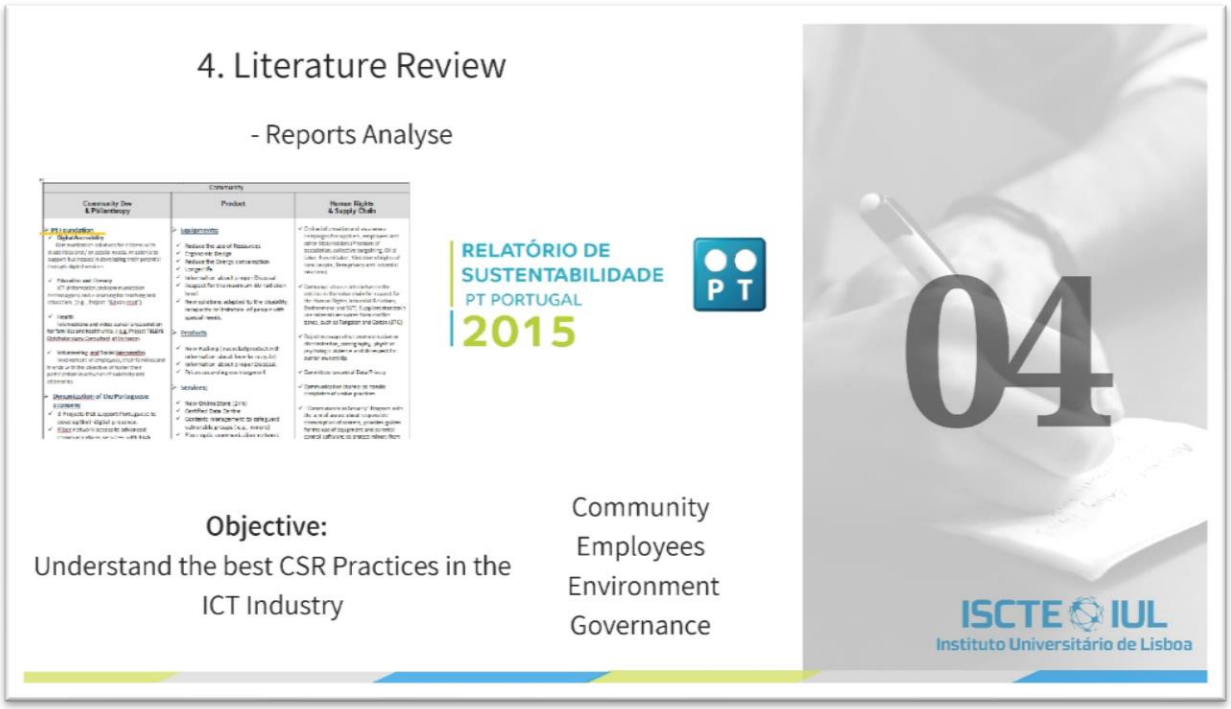
(Slide 3)



(Slide 4)

(Slide 5)

(Slide 6)



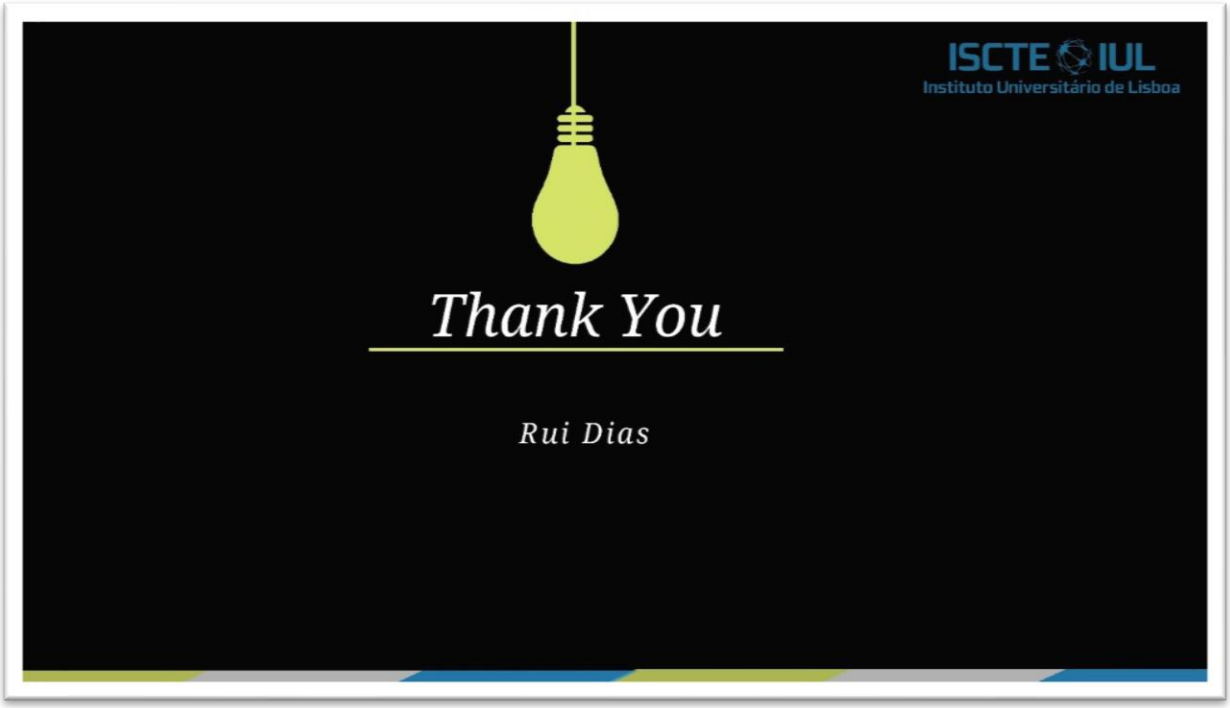
(Slide 7)

5. Objectives

Benchmark the Best Practices in the ICT Industry and propose new initiatives that Altice Portugal could implement towards Corporate Social Responsibility in the **Healthcare Elderly sector.**

6. Methodology?

(Slide 8)



5. Questions Guideline: Visit to Altice Labs (5 December)

“SmartAL – Smart Assisted Living”:

1. What is the purpose of this Platform?
2. Who can benefit with this solution? Which are the potential Clients?
3. Is this platform already certified for medical use?
4. What are the challenges for designing this platform elderly people?
5. What are the main services provided?
6. How to use this platform?
7. Information protection and security is guaranteed?
8. What are the improvement objectives for the future?