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Drivers of customers' adoption and use in digital health services: an exploratory study

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To my family

Abstract

Advances in digital technologies and data science over the last few years have been the main factors to impact digital health. The pandemic caused by COVID-19 has spread across the world, changing the form of delivery of several services, including for health care systems. Therefore, health care has embarked on a paradigm shift into what is now commonly referred to as digital health. Digital health, however, relies heavily on human factors to succeed.

This research aims to understand patients' changing beliefs, needs and responses towards digital health services, especially in the post pandemic times, by exploring attitudes towards the adoption of digital health services.

With this purpose, a qualitative methodology was applied. For data collection, a sample of ten interviews was considered. The interviewees comprised experts in digital health solutions in Portugal, considering the following categories: from physicians, managers of digital health services, directors of information technologies services, policy makers, professors, and researchers. The study conducted semi-structured interviews where the script is more-or-less partially developed with questions to be put to the interviewee to guide the conversation and offering room for improvisation. The interview scripts were developed based on the frameworks proposed by Myers & Newman (2007) and Gioia et al. (2013).

The results obtained, included findings regarding the patients' changing beliefs, needs and responses towards digital health services and the drivers of use and adoption. Individuals feel more motivated to engage with digital health when having a medical condition. The age, user's ability to use digital technology, social trends and marketing for a healthier lifestyle are factors that influence the use and adoption of these solutions. Experts acknowledged that the pandemic impacted the digital health usage through different ways by making room for new service providers and solutions to emerge, and by forcing the use of these technologies and therefore overcoming some misconceptions and myths about digital health. The mainly perceived added valued for users is the facilitation of a better health self-management and more timely and reliable medical services.

The data collected revealed that the main barriers are related to illiteracy, lack of clear information about the advantages of digital health, and lack of trust and negative personal beliefs towards digital health services.

At a technological level, some insights were collected regarding which elements and aspects should be considered for the design and development of a digital service. The need for interoperability and a simple interface throughout the system represent a critical element for a successful technology. The recognized challenges are the need for a better communication and promotion of the value of digital health to overcome health illiteracy and health disparities. At a macro guidance point it lacks regulation, certifications, financial and political incentive. At the design and development level, there is a need to have a multidisciplinary service design team, following a service design process and design it from a patient-oriented perspective.

KEYWORDS: digital health, COVID-19 pandemic, digital health solutions.

Resumo

Nos últimos anos os principais fatores que impactaram o crescimento da saúde digital foram os avanços na tecnologia e nas ciências da informação. A pandemia causada pelo COVID-19 alterou a forma de prestação de diversos serviços. Os sistemas de saúde não foram exceção. Os cuidados de saúde enfrentaram uma mudança de paradigma para o que agora é comumente referido como saúde digital. O sucesso da implementação e adoção da saúde digital é altamente dependente de fatores humano.

Esta pesquisa pretende explorar as mudanças nas crenças, necessidades e respostas dos pacientes em relação aos serviços de saúde digitais, especialmente nos tempos pós-pandemia.

Neste âmbito, foi aplicada uma metodologia qualitativa. Para a recolha de dados, foi considerada uma amostra de dez entrevistas. O grupo de entrevistados consiste em especialistas em soluções de saúde digital em Portugal, considerando as seguintes categorias: desde médicos, gestores de serviços de saúde digital, diretores de serviços de tecnologias de informação, decisores políticos, docentes e investigadores. O estudo realizou entrevistas semiestruturadas. Sendo que o guião foi desenvolvido com o intuito de orientar a conversa e oferecer espaço para improvisação. O guião da entrevista foi desenvolvido com base nas propostas de Myers & Newman (2007) and Gioia et al. (2013).

Os resultados obtidos demonstraram as mudanças de crenças, necessidades e respostas dos pacientes em relação aos serviços de saúde digitais e quais os seus fatores de uso e adoção. Os indivíduos sentem-se mais motivados a interagir com a saúde digital quando possuem algum tipo de condição médica. A idade, a capacidade do usuário de usar a tecnologia digital, as tendências sociais e a promoção para um estilo de vida mais saudável são fatores que influenciam o uso e adoção destas soluções.

Os especialistas reconheceram que a pandemia impactou o uso da saúde digital de diferentes formas. Criou oportunidade para o surgimento de novos provedores de serviços e soluções, forçando o uso destas tecnologias e, portanto, superando alguns estereótipos e mitos em relação à saúde digital. O principal valor acrescentado percebido pelos usuários é a facilitação de uma melhor autogestão da saúde individual e da presença de cuidados de saúde mais oportunos e de confiança.

Os dados recolhidos revelaram que as principais barreiras estão relacionadas ao analfabetismo, desinformação sobre as vantagens da saúde digital, a desconfiança e crenças pessoais negativas em relação aos serviços de saúde digital.

A nível tecnológico, foram recolhidos alguns dados relativos a quais os elementos e aspetos que devem ser considerados para o desenho e desenvolvimento de um serviço digital. A necessidade de interoperabilidade e de uma interface simples em todo o sistema revelaram ser um elemento crítico para uma tecnologia com sucesso. Os desafios reconhecidos são a necessidade de uma melhor comunicação e promoção do valor da saúde digital de forma a superar o analfabetismo e as disparidades na saúde. No que toca ao panorama mais macro, existe uma carência de regulamentação, certificações, incentivo financeiro e político. Ao nível de desenho e desenvolvimento, é fundamental ter uma equipa, seguindo um processo de desenho do serviço e projetando-o a partir de uma perspetiva orientada ao paciente.

PALAVRAS-CHAVE: saúde digital, pandemia COVID-19, soluções de saúde digital.

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List of Abbreviations

ICT- Information and Communication Technology

ICTs- Information and Communication Technologies

WHO - World Health Organization

EHR- Electronic Health Records

TAM- Technology Acceptance Model

HIT- Health Information Technology

1 Introduction

1.1 Background and Motivation

The expansion of Information and Communication Technologies (ICTs) in the past decades has led to a digital revolution in various areas with health care being no exception. In the 1990s, terms such as 'e-health' and 'electronic health' started to appear in the literature due those the developments in ICT and the fast-growing capacity to process and analyse large volumes of data has been the main driver for the evolution of digital health (Duarte & Pinho, 2019; Meskó et al., 2017).

The coronavirus (COVID-19) pandemic has put pressure on the capacities of public and private health institutions and health systems. It required the leveraging of the collective resources from public institutions, including the utilization of their technological capacities. It strengthened the importance of individuals of tracking their health and taking safety precautions when managing their day-to-day life. The physical health care delivery structure presented a risk for other patients. Systems, therefore, played a significant role in delivering and assisting health care services to break the pandemic chain. The COVID-19 pandemic and the demonstrated importance of the need of real-time information sharing and fast decision-making have been major boosters for the shift towards e-health solutions (Keesara et al., 2020; Petracca et al., 2020).

The way health care is delivered has indeed changed in the past years. Digital health came to stay contributing to economic efficiency, improved safety and efficacy, lower mortality rates, and a decrease in medication errors, among others. On the other hand, digital health has proved to fail in aspects such as reducing health care disparities, solving privacy concerns, overcoming credibility issues, having clear macro guidance, regulation, and incentive from political institutions, among others (Adjekum et al., 2018; Galetsi et al., 2022; Schueller, 2021). Therefore, digital solutions providers still struggle to gain user acceptance for this type of solutions.

Not only the advances in technology but also the consideration of human factors offer space for improvement in e-health. Human factors encompass the human emotions, behaviours, and cognitions related to the design, adoption, usage, and implementation of smart health services (Schueller, 2021). Overall, there are significant challenges related to the use and adoption of digital health solutions from the patient viewpoint (Liu et al., 2019; Vayena et al., 2018).

Service systems are configurations of people, technology and other resources that interact with other systems to cocreate value. The study of the drivers and objectives of users are key to support the design and development of these services. Such understanding allows to explain the user's experience, future intention, satisfaction, and engagement. In the case of digital health service systems, understanding the factors and challenges that affect digital health services acceptance has been subject of various studies, where extrinsic and intrinsic motivations have been taken into consideration. The mainly identified endogenous factors include ICT literacy, health literacy, health condition and privacy perception and exogenous factors include the growth of preventive medicine and the pandemic context, among others (Adjekum et al., 2018; Anshari et al., 2021; Jung et al., 2022; Whitelaw et al., 2020).

1.2   Research questions

Taking into consideration the relevance of this topic in the past years and how digital health can offer significant opportunities to reshape and improve the current health care and how potential to improve user acceptance and adoption for this type of services remains a significant challenge for managers, public and private institutions, service providers, and users such as: patients, medical staff, and physicians, among others. This research seeks to contribute to improve the understanding of patients' changing beliefs, needs and responses towards digital health services especially in post pandemic times by exploring their attitudes towards the adoption of digital health services. The specific research questions the following:

RQ1: What are the drivers of customers' adoption and use of digital health services?

RQ2: What are the main barriers for the adoption and use of digital health services?

RQ3: Which are the major challenges for digital health services?

1.3   Methodology

To address these research questions, a literature review and qualitative research were employed. The literature review aimed to identify and characterize the individuals' perceptions and attitudes towards the adoption and use of digital health services. The qualitive research sought to investigate acceptance drivers, and explore barriers and challenges based on expert opinions.

In the qualitative research study, 10 semi-structured interviews were conducted, to a sample comprising experts in digital health solutions in Portugal, in the following categories: physicians, managers of private hospitals, managers of digital health services, directors of information technology services, policy makers, professors, and researchers.

Considering the changing landscape, the goals of this research, therefore, are:

- to assess expert 'perceptions of the drivers of customer' adoption and use of digital health services,
- to assess expert 'perceptions of the challenges and barriers of digital health services,
- to offer interesting insights to develop new or renewed practices that foster the reshaping or maintaining of a digital health service, namely in the form of recommendations to managers, health service designers and developers, governmental institutions, researchers, and other interested stakeholders.

1.4   Structure of the dissertation

The research is structured as follows. In the next chapter, the main academic contributions on service design and value co-creation are reviewed and properly explained, focusing on the area of digital health services. This is followed by the description of how the research question is addressed while relating with some conceptual background on customers' attitudes, beliefs, and usage intentions toward digital health services. The results of the qualitative study based on collecting and analysing interview data from experts in digital health in Portugal, are presented next. Finally, the discussion of the research findings and the conclusions are detailed and an agenda for future research is suggested.

2   Literature Review

This chapter introduces the most relevant literature related to digital health solutions, namely, digital health technologies and services, including the respective definitions, advantages, disadvantages, and challenges. Additionally, a literature review on customers' attitudes, beliefs, and usage intentions toward digital solutions is also presented.

2.1   Digital Health

The traditional physical health care delivery structure is losing its effectiveness and has difficulty to accommodate the increasing population needs (Meskó et al., 2017). Such has been demonstrated during the COVID-19 pandemic with consumers, physicians and health systems being pressured to adopt these digital health technologies. Hospitals were forced to do remote appointments and to reschedule procedures to decrease the risk of infection. Such provided an opportunity emerged to develop and test the capacity of digital health technologies and services all over the world.

According to the US Food and Drug Administration (2020), digital health can be described as the group of mHealth, wearable devices, telehealth, telemedicine, personalized medicine, electronic health records (EHRs), and health information technology (HIT).

Each of these key technologies is defined next:

- WHO describes mHealth as mobile wireless technologies for public health.

- According to Glaros & Fotiadis, (2005), a wearable health care device can be defined as 'a device that is autonomous, that is non-invasive, and that performs a specific medical function such as monitoring or support over a prolonged period. The collected data can be transmitted to smartphones or medical monitors for detailed analysis, thereby providing useful health information'.

- Telehealth is the use of telecommunications technology in health care delivery, information, and education (Gajarawala & Pelkowski, 2021).

- Telemedicine is the delivery of health care and the exchange of health information across distances, including all medical activities: making diagnosis, treatment, prevention, education, and research (Wootton et al., 2017);

- The Horizon 2020 Advisory Group defines personalised medicine as 'a medical model using characterisation of individuals' phenotypes and genotypes (for example: molecular profiling, medical imaging, lifestyle data) for adapting the right therapeutic strategy for the right person at the right time, and/or to determine the predisposition to disease and/or to deliver timely and targeted prevention (Terkola et al., 2017).

- Electronic Health Records (EHRs) are the digital storage of the clinical and administrative health care information about an individual's lifetime of health experiences, for the purpose of supporting continuity of care and education and research, while ensuring confidentiality. The EHR is a tool for supporting health care delivery,

through all stages and at all points of care, linked via health telematic networks (Silber, 2003).

- Health Information Technology (HIT) involves the processing, storage, and exchange of health information in an electronic environment.

Digital health involves multiple dimensions, including disease prevention and monitoring, diagnosis and treatment, hospital management, health decision-making, and research. From the perspective of patients, the point of view considered for this research, they can use wearable devices to monitor their health, seek medical assistance through virtual assistants, use some sort of personalised medical care, among others. From the perspective of doctors, a variety of intelligent clinical decision support systems are used to assist and improve diagnosis. These technologies offer significant opportunities to reshape and improve the current health care systems such as: economic efficiency, improved safety, and efficacy, clinical reliability, personalized medical services, more informed decisions, shorten mortality rates, decrease in medication errors, among others (Anshari et al., 2021; Balta et al., 2021; Tian et al., 2019).

2.2 Service Design and Digital Health

Digital health can be understood as an interconnected health system care network that promotes interactions between all parties in the health care field. Hence, it seeks to ensure that participants get the services they seek and helps all parties make more informed decisions by facilitating the rational allocation of resources.

The future of health care includes an arrangement of traditional health care providers, new players from the fields of technology and customers as co-creators of health care experiences. Value co-creation is cocreated by the actors when resources are used and combined in different ways (Beirão et al., 2017). Customer experiences are co-created through all interactions between customers and the organization and cannot be designed, but services can be designed for the customer experience (Patrício et al., 2018). Such experiences play a fundamental role on defining the customers' preferences and on understanding the user's experience, which then influence their decisions, future intention, satisfaction, and engagement.

The following figure 1 shows the main stakeholders on a health care system network. According to Ostrom et al., (2015), service design can be defined as the orchestration of clues, places, processes, and interactions that together create holistic service experiences for customers, clients, employees, business partners or citizens.
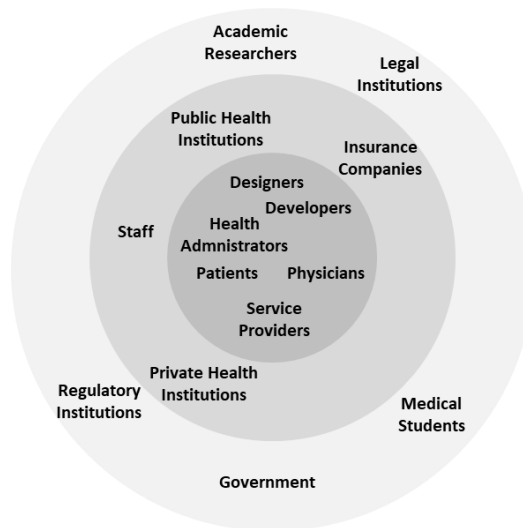
Figure 1- Stakeholders Map (by the author)

On a service design process, the iterative flow follows four stages: (1) exploration, (2) ideation, (3) reflection and (4) implementation. The exploration stage is crucial to feed subsequent phases of the service design. There is a vast collection of methods used from interviews to participatory design (Patrício & Fisk, 2013).

The design of a service is a systematic process based on a deep understanding of the person's context and motivations, the delivering company or organization and market strategies. The study of the drivers and objectives of users are key to support the design and development of these services. The usage and acceptance of digital health is indeed complex since several service characteristics, users' psychological dimensions and demographic characteristics are taken into the equation. Its use and adoption will be determined by the stakeholders' ability to overcome structural impediments and to align the benefits around patients' needs and expectations (Duarte & Pinho, 2019).

2.3   The background of the study

As part of the literature review, internal and external factors, customers' perceived utility and added value, user friendly characteristics for digital health services, barriers and challenges towards digital health technologies were discovered. Such are formed by complex belief structures. This research provided a starting point for the exploratory study whose aim is to investigate expert' perceptions of customers' attitudes, expectations, and perspectives toward digital health and highlight some potential enablers and impediments for customers to adopt and use digital health technologies and services.

2.3.1   Factors that influence customer's adoption and use of digital health services

Studies indicate that the adoption and usage of digital technologies by patients is affected by a variety of elements. The enablers of adoption and use of digital health technologies refer to those factors that encourage patients whereas barriers denote the factors that can potentially be an impediment. The literature has mainly identified factors such as technology features or

individual users' attitudes toward the technology as antecedents of service acceptance (Featherman & Pavlou, 2003).

At an individual level, considerable literature has argued that sociodemographic factors such as age, socioeconomic status, level of education, health and digital literacy can influence positively or negative the digital health technologies acceptance.

Barriers to and internet access and use may emerge from financial restrictions (equipment and internet access costs are high), medical and disability-related constraints (the technology is not easily accessible for some patients) and digital complexity. Several authors show health literacy plays a significant role in enabling people to access and use the Internet for health-related purposes (Estacio et al., 2019).

Additionally, some psychological characteristics, such as: the extent of trust in technology, the unwanted or the level of desire for personal contact, self-efficacy beliefs and personal motivation can have a role in service acceptance. (Jung et al., 2022; Liu et al., 2019; Nutbeam, 2021; Wünderlich et al., 2013).

The individual' health condition is also pointed out as a factor. Individuals are more likely to engage in routine use of digital health services when they have chronic diseases, desire to improve health management, and live independently. Such individuals are more likely to integrate digital technologies into their daily lives since they feel more motivated to manage their health status and adopt healthy habits (Liu et al., 2019). On the other hand, other studies have showed that chronically ill patients may have negative health-related emotions like fear of diseases and privacy concerns that may impede their self-management (Li et al., 2019).

The technological elements are those technical components of digital technologies that make users more appealed to adopt it. The Technology Acceptance Model, (TAM) is one of the most influential models of technology acceptance, with two core constructs influencing an individual's intention to use new technology: perceived ease of use and perceived usefulness. Perceived usefulness refers to a user's beliefs that using a technology will increase job performance and ease of use refers to the degree to which a user expects use of a system to be free of effort. In the TAM, usefulness has significant effects on behavioural intention and ease of use strongly affects both usefulness and behavioural intention.

Other elements that are proven to positively affect usefulness and ease of use are: accessibility, service quality, quality support, information quality, usage time, compatibility, response time, usability, role clarity and customizable design features have been demonstrated to affect the adoption behaviour (Daim et al., 2013). Studies have examined user experience and desired functions such as the existence of sufficient information in a simple way to access it and use it, users' evaluations, and features that are timesaving, simple, and intuitive.

Simple and easy technologies are imperative for a good user experience. Complex portal interfaces may present a barrier to use. Studies show problems ranging from with the registration process to the self-report of health information. Such problems are often associated with the lack of prior training, which that may also constitute an essential element for the improvement of the use of technologies (Meskó et al., 2017).

The ability to enhance human contact by better connecting patients to family, friends and healthcare professionals is also pointed out as useful in digital healthcare, making users feel accompanied and supported (Anshari et al., 2021).

Other external factors that are highlighted by several studies are economic gains, accessibility and convenience since digital health solutions enable consumers to manage health care anywhere at any time. On the other hand, the perceived financial cost is found to negatively affect the adoption and use of the service.

Additionally, the stakeholders' integration, engagement, and specifically the service provider reputation are also proved to be important factors to take in consideration (Adjekum et al., 2018; Wünderlich et al., 2013). The social influence variable, defined as 'the person's perception that most people who are important to the individual think she/he should or should not perform the behaviour in question' was also found to have a direct positive effects on behavioural intention and usefulness. Therefore, social influence facilitates the successful implementation of new IT services in the medical industry, fostering performance gained by the service, and decreasing the effort required to use it (Daim et al., 2013).

2.3.2 Perceived value for the patient when using digital health services

Perceived value can be defined as a ratio of total gains to total sacrifices expected. The perceived value seeks to capture the customer's overall perception-based assessment of a service regarding what is received and given (Itani et al.,2019).

Recent literature focuses on the value of digital health technologies through the empowerment of customers. Empowerment can be defined as 'a process through which people gain greater control over decisions and actions affecting their health' (World Health Organization, 2016).

For patients, digital health services mean access to health-related information that most individuals never had. Hence, they gain more control allowing individuals to have more autonomy over their own health (Balta et al., 2021). Additionally, ubiquity and accessing the right health services in a timely manner and at a lower cost, from any location, is a critical recognized outcome.

2.3.3 Challenges for digital health

Nevertheless, there are challenges associated with digital health care, including, for instance, privacy concerns about personal health information (Adjekum et al., 2018; Haggstrom et al., n.d.), immaturity of the technology being used, lack of uniform standards and regulations among different organizations and regions (Meskó et al., 2017; Tian et al., 2019).

At a more global level, there is insufficient macro guidance, regulation and incentive from the political institutions that define development goals for the future. Innovators and managers have difficulties in integrating their solutions with outdated and over-regulated health care systems which are not compatible with the new models of care (Meskó et al., 2017).

At a societal level, several challenges are yet to overcome, namely, difficulties on the access of these technologies, health literacy and increasing social disparities. On an individual level, there is still a lack of trust in these technologies, lack of accountability for their own health, lack of personalized care solutions, among others (Adjekum et al., 2018; Estacio et al., 2019; Schueller, 2021; Tian et al., 2019).

3   Methodology

3.1   Reasons for the choice of adopted approach

In this study, conceptual and empirical articles published in health care research (medicine, consulting in health care), and service research (including trends, consumer behaviour) were analysed.

Following Edmondson & McManus methodological fit, three stages of the development theory can be considered for this research: nascent, intermediate, and mature (Edmondson & McManus, 2007). The nascent theory refers to topics which have little or zero research done. The intermediate theory develops provisional explanations of phenomena with new constructs and proposing relationships. Whereas the mature theory focuses on well-developed constructs and models supported by extensive research on a set of related questions.

This research draws from the prior literature research on chapter 3; however, a new phenomenon is taken into consideration, the pandemic of COVID-19. Taking this into account, this research can be considered in between the nascent and intermediate stage theory. Therefore, to understand and investigate shared beliefs about digital health and considering the post pandemic context it is employed a qualitative approach.

3.2   Method used in the research

Aiming to understand patients' changing beliefs, needs and responses towards digital health services specially in the times of post pandemic, 10 semi-structured interviews were conducted to experts in digital health services. The sample comprised experts in digital health solutions in Portugal from physicians, managers of key players of digital health services companies in Portugal, directors of information technologies services, policy makers, researchers, and professors. The proposed sample was selected due to their profound knowledge and experience inside the digital health area. The interviewees were carefully selected considering their different contributions and background that permitted a multidisciplinary sample for this study. The interviewees were approached via email or LinkedIn.

For this type of interview the script is more-or-less partially developed with questions to be put to the interviewee to guide the conversation and offering room for improvisation. The interview scripts were developed based on the frameworks proposed by Myers & Newman (2007) and Gioia et al. (2013). Most of the interviews were done remotely via Zoom and the others physically. The average duration of the interviews is around 35 minutes. The data collection period for this research occurred between 6 May and 21 June 2022.

After the data collection process, each interview went through a careful full-transcription process. The data analysis was supported by the software NVivo12 and followed Gioia et al., Methodology (Gioia et al., 2013). Because of the interviews, in the data analysis ten categories emerged, those will be analysed carefully in the next section.

To capture concepts relevant to the study of the use and adoption of digital health services as well as its challenges and barriers a systematic inductive approach to concept development was carried out in chapter 4. Following Gioia's methodology, the experts interviewed were viewed as 'knowledgeable agents'. Consequently, the prior research was not imposed on the interviewee allowing for an unbiased contribution.

The main dimensions were created early in the research and then after this exploratory data analysis more dimensions emerged building what is the current data structure: Factors, Perceived Utility and Added Value, User Friendly Characteristics, Barriers, Challenges, Social Beliefs, Risks, COVID effects and Types of Digital Health. The table 1 above shows the characterization of the sample taken into consideration for this research.

Sociodemographic Data	
Sample= 10	
Gender	
Female	5
Male	5
Region	
Lisboa	3
Porto	7
Degree	
Phd	4
Masters	4
PGDM	2
Field	
Statistics	1
Economics	1
Social Sciences	1
Medicine	5
Engineering	2
Profession(s)	
Professor & Researcher	2
Manager	3
Physician	2
Physician & Researcher	1
Health Policies and Management	1
Director of IT Services at a Public Hospital	1

Table 1- Sample Categorization

4   Findings

This section details the main results obtained through the analysis of the interviews, relating them with the previously presented literature review. The main categories are introduced and explained, and the terms that emerged during the analysis of the collected data are also presented. The analysis leads to will provide a framework for understanding the factors that influence user responses to digital health services.

Table 2 shows the main dimensions that emerged during the collection and analysis of the interviews. The categories 'Factors', 'Challenges', 'Barriers', 'Perceived Utility and Added Value' and 'User Friendly Characteristics' emerged naturally according to the questions and the structure of the interview. The semi-structured interview was created with the aim of obtaining the most relevant information to address the research questions of this research. Across the interviews, the categories ''medical condition', 'types of digital technologies', 'social beliefs', 'risks' and 'COVID-19 effects' were created when denoting the frequency of it reference. The second column shows the number of times that each category was mentioned in all the interviews.

Categories	References
Factors	128
Challenges	72
Barriers	72
Perceived Utility and Added Value	61
User Friendly Characteristics	59
Social Beliefs	33
Types of Digital Health	25
COVID-19 Effects	23
Medical Condition	21
Risks	10

Table 2- Categories

4.1   Types of Digital Health Solutions

Table 3 shows all the types of digital health solutions that were mentioned across the interviews. All types of digital technologies were mentioned at least once in the set of interviews. The interviewees often during the conversation used examples of health technology to build their ideas. Wearables were the most mentioned among all technologies, being understood as devices either carried on the body or included in a piece of clothing that monitors physiological data like the amount of activity, heart rate, or blood pressure. The collected data can be transmitted to smartphones or medical monitors for detailed analysis, thereby providing useful health information. The three different types of wearables were explored: 1) disease management; 2) disease prediction; and 3) activity monitoring (Lee & Lee, 2018). Often connected with the

data driven from these wearables, experts would immediately mention the EHRs and the potential of the integration of both in the future.

Sub-categories	References
Wearebles	6
EHRs	6
Telehealth	5
Telemedicine	5
Images Analysis	4
Chatbots	2
Personalized Care	1

Table 3- Types of Digital Health Technologies

Chatbots were the only more uncommon type of digital health technology mentioned by the interview. A chatbot is a computer program that simulates and processes human conversation (either written or spoken), allowing humans to interact with digital devices as if they were communicating with a real person. The experts referred to the tool's potential to decrease the unnecessary trips to the hospital and to increase efficiency.

4.2   Factors that influence customer's adoption and use of digital health services

Internal factors are the individual characteristics that influence behavior and actions in a person. Such factors can be individual personality traits, background, motivation, and perceptions. Throughout the interviews the sociodemographic factors were the most mentioned among the internal factors.

Being older was often recognized to negatively influence the user's predisposition towards using and adopting digital health services. Such was justified by two main reasons: 1) the traditional relationship between the physician and the elderly and, 2) the diminished ability to interact with technology.

'There are several traditions in this patient-physician relationship. And that gets lost in a more digital, impersonal contact. It's not the same. It's a cultural issue people still like human contact. And this is especially noticeable in the older generations.

(Health Policy Maker)

'Maybe if we're talking about people who are 70, 80 years old, they might not be very willing to have an electronic gadget while if it's someone from the new generations, if it is non-electronic it is weird.'

(Physician and Lead Medical Advisor)

The level of education was distinguished between IT literacy and health literacy. The lack of health education and its negative influence on digital health services was a common topic

discussed across all interviews often related with one of the major challenges and barriers for digital health. There was a general concern on the how low the level of health education is in Portugal's reality, threatening the adoption and usage of digital health technologies.

'There are a lot of people who don't realize the difference they can make in their lifestyle and the importance of preventive medicine. Some coaching can be done by the family doctor.'

(Health Policy Maker)

Sub-categories	References
Internal Factors	72
Sociodemographic Factors	27
Age	6
Education Level	14
Digital Literacy	8
Health Literacy	6
Social-Cultural Factors	7
Individual Traits	17
Healthy Lifestyle	8
Need for Feeling Accompanied	3
Need of Being up- to-date	1
Preference for Physical Contact	5
Health Condition	12
Relationship with Technology	5
Relationship with Health care	4
External Factors	49
Efficient	9
Influencers	9
By Friends & Family	2
By Physicians	6
Costs	7
Interoperability	5
Necessity	5
Usability	5
Marketing Strategies	3
Usage Time	3
Access to Technology	2
Discrete	1

Table 4- Internal and External factors

On the other hand, digital literacy did not have such a clear agreement. Some experts considered that most of the individuals these days can naturally learn how to use a simple technology, whereas others recognized that there is still a considerable number of people that do not know how to use a digital health technology, as illustrated in the following quotes:

'Illiteracy is increasingly rare. Everybody can use Youtube, right? The software is good, intuitive, and simple. Anyone can use it. If we want to talk about digital medicine, we want to move towards that direction. To be so simple that anybody can use it.'

(Manager at a Company of Telemedicine Platform)

'There is a huge lack of literacy. Technological literacy as well. There are a lot of people who don't know how to use a computer. Especially the older people. And it's the older people who rightly use health care the most.'

(Health Policy Maker)

Additionally, among the socio-cultural factors, experts considered that the cultural movement for a healthier lifestyle is a driver to increase the usage of digital health services, whereas the traditional doctor-patient relationship, of particularly in older generations seems to negatively affect the usage and adoption of these services.

The previous experiences with health care and with technology have been pointed out as important on dictating the current and future relationship with digital health care. Individuals with bad experiences in traditional health care are more prone to using digital health services than people with good experiences. Regarding the previous experiences with technology, individuals more used to interacting with technology will fear less using a digital health solution. Moreover, the ones that have digital dependency will be highly motivated to interact with it.

Concerning digital dependency, one category emerged also inside 'individual traits'- the need of an individual to be up to date with the latest technology. Such need varies according to the interests of the individual but can be an important driver for a patient to engage and have more interest in digital technologies and services. Among the individuals' traits, intrinsic motivation to have a healthier lifestyle and the desire to feel more accompanied by a health provider were indicated as drivers. On the other hand, the preference for physical interactions seems to negatively affect the adoption of digital health services.

As the table 4 shows, the medical condition is a main factor to take into in the scope of this topic. Most of the experts interviewed recognized that the presence of a health condition often indicates that the individual is more motivated to engage with digital health solutions.

The most referred to conditions were chronic diseases as it is possible to see in table 5. However, a small percentage of the experts considered that the presence of a medical condition may be hostile towards the adoption of digital technology solutions since the patients have closer ties with the traditional health systems and their physicians.

'Chronic patients tend not to be more likely to use telemedicine, because they already have a relationship with their doctor who has been with them for a long time.'

(Policy Health Maker)

Sub-category	References
Chronic Diseases	7
Allergies	1
Diabetes	3
EM	1
Hypertension	2
Cancer	2
Pregnancy	2
Vision problems	1

Table 5- Medical Conditions

The external factors are those influences that do not occur from within the individual but from elsewhere. The two main drivers recognized by the experts are the efficiency brought by the digital health services, and the service or technology being recommended by someone the individual' trusts. The recommendation of a digital health service by a physician was more mentioned than by friends and family.

'Telemedicine does not interfere with routines. People can do their remote appointment on their way to work or even while traveling.'

(Manager at a Digital Platform for Health Literacy and Chronic Disease Management)

The efficiency brought by the digital health services was often described as the better allocation of resources from all parties and without interrupting the day-to-day activities. Therefore, the lower costs in particular transportation costs, and the shorter usage time of the digital technology were also pointed out as factors that influence positively the adoption of these services.

The necessity, meaning to be left with no other choice was often mentioned to be a crucial factor for the push of the usage of such technologies. More than 1/3 of the experts gave the example of the pandemic push caused by covid-19.

'During the last two years COVID-19 created a series of requirements that have forced people to learn how to work with the technologies.'

(Manager at a Digital Platform for Health Literacy and Chronic Disease Management)

To be able to answer to this necessity, the technology must be prepared and show usability and interoperability. Such elements are crucial for the experience of the user that in turn dictates the loyalty to the service.

> *'Health care has a particularity; it is very reactive to need. If at the time of need the accessibility is not in the palm of my hand, in other words, if I don't have everything ready to use, I'm not going to use it. It's a barrier to use. And, therefore, need is a conditioning factor. If I have a need for something that is more easily done by telemedicine, I'm more likely to use telemedicine.'*

> (Manager at a Company of Telemedicine Platform)

Finally, the marketing strategies were also stated to have a positive effect on the customers tendency to have a healthier lifestyle often refer to 'Digital Health Coaching'.

4.3 Perceived utility and added value for the patient when using digital health services

Sub-categories	References
Efficient	15
Convenience	10
Access to Health Data	8
Accessibility	7
Sense of Being Supported	7
Control	7
Satisfaction	3
Clinical Reliability	3

Table 4- Perceived Utility and Added Value

The table 6, provides valuable insights that help answering RQ1. In line with the results found on the literature, the number one added value and perceived utility identified by the experts interviewed is efficiency. The convenience of these services and easy accessibility were also considered to be factors valued by customers. Accessing the right and health services in timely manner at a lower cost from any location is a critical recognized outcome.

As identified in the literature review value for customers of digital health technologies was also demonstrated to reside on the greater control and access to their own health data providing therefore more empowerment to the individuals. Moreover, the capacity to monitor and control such data through technology was also pointed out to be a more reliable way to collect health data since it is less subject to human error.

> *'People realize what they can do for their health. In terms of chronic disease management, it also matters because people become more autonomous in managing their health.'*

> (Director of Information Systems at a Public Hospital)

Additionally, it was recognized that the contact with the service provider in an easier and more accessible way enhances the sense of being supported and accompanied in their health management decisions.

4.4 Barriers to the adoption and usage of digital health services

Regarding the barriers identified in the exploratory study for the purpose of a better understanding table 7 splits the internal and external factors that may represent an impediment to adoption and usage of these technologies.

As already presented in section 4.1., on the internal factor side, the individual's need for physical contact, the digital illiteracy and the health illiteracy represent an impediment to the usage of digital health services. Often associated with this illiteracy it was also mentioned the lack of trust on the digital health information because of the incapability to interpret and understand health data and digital advantages. Personal beliefs towards digital health services also emerged on the interviews highlighting the lack of credibility some individuals give to digital health.

'People in general think that if it is an appointment at distance, it does not count as real an appointment. They tend to discredit it.'

(Physician)

Sub-categories	References
External	29
Lack of Information	10
Interoperability	7
Access to Technology	5
Complex Systems	4
Costs	3
Need of First Adopters	3
Lack of Regulation	2
Internal	30
Health Illiteracy	7
Habits	6
Lack of Trust	5
Physical Contact	5
Personal Beliefs	3
Digital Iliteracy	2
Security Concerns	2

Table 5- Barriers

The human nature of routine and habits were topics brought up several times to justify why digital technologies are not yet successful among populations. The need of first adopters may represent a key to break this cycle.

'Not having someone to reference them makes a lot of difference. If I have someone in the family who has already used it is easier to scale. You need to have some first adopters who convince others to use.'

(Professor and Researcher of Medical Informatics)

Lastly, data protection concerns were surprisingly not recognized by the experts to be a concern. Such was either explained by the lack of interest and knowledge of such issue or the easy tradeoff between utility and data protection.

'I think most people don't care about the privacy issues because they don't know where their data is going.'

(Director of Information Systems at a Public Hospital)

Concerning the main external factors considered by the experts to represent barriers, the most salient one was the lack of information, which seems to shape some internal factors such as lack of trust, security concerns, or personal beliefs.

'I think there is a communication problem that often starts in the health care professional. Physicians often don't give the context or the framework of what the health solution is what are the advantages.'

(Manager at a Digital Health Company)

The lack of access to technology was highlighted as a factor that despite recent improvements namely becoming increasingly more affordable, still affects a relevant part of the population, for either financial or political reasons.

The lack of interoperability between the systems was considered by numerous experts to be an impediment to taking advantage of all the benefits that digital health has to offer. Interoperability can be defined as the ability of different systems, devices, applications, or products to connect and communicate in a coordinated way, without effort from the end user. Therefore, without this element the solutions fail to demonstrate their right value.

Four references were made to the existence of complex portal interfaces. These portals can be difficult and time-consuming leading the user to give up and abandon the system. Such results are in accordance with to the Technology Acceptance Model.

'A more concrete example is the Nacional Health Service platform. (…) One of the main barriers has to do with a security solution that they decided to implement. Any individual can go there and validate their identity by using the mobile digital key. But the use of the mobile digital key is difficult. (…) And so most people can't access their platform because they can't validate their identity because the government has implemented an identity validation solution that is difficult.'

(Manager at a Digital Platform for Health Literacy and Chronic Disease Management)

4.5   Characteristics of user-friendly digital technologies

Some of the technological characteristics previously identified as positively affecting service acceptance were also corroborated in the exploratory research: ease of use, simplicity, short usage time, the existence of desired information such as user's evaluation and data evolution, compatibility, and role clarity. In terms of aesthetics, some experts emphasized the importance of a good design and interface so that the individual will have greater interest in the technology.

Sub-category	References
Ease of Use	12
Simplicity	11
Clean Process	11
Design with Customers	6
User Experience	4
Historic and Evolution Visibility	3
Appealing	2
Intelligible	2
Integration with Others Systems	3
Human Interaction	2
Feedback System	2
Web-based	1

Table 6- User Friendly Characteristics

'Typically, it must have few steps, it has to have good usability with the user understandings clearly what they have to do. Solutions must be robust and consider about who the user will be.'

(Director of Information Systems at a Public Hospital)

As was also pointed out in the literature review the ability to have human contact by connecting patients to family, friends, and health care professionals is seen as useful and valued in digital health services. Among the experts the physicians emphasized the importance of intelligible information to combat disinformation and help on the interpretation of the data collected.

4.6   Challenges for digital health services

Table 9 presents, the list of the main challenges associated with digital health, such include some already reviewed in the literature, such as, privacy concerns about personal health information (Adjekum et al., 2018; Haggstrom et al., n.d.), health literacy, lack of a centralized health care system with uniform standards and regulations among different organizations and regions (Meskó et al., 2017; Tian et al., 2019) and lack of financing and political incentives.

'A digital health service can't just be from one region it has to be national. Hospitals consider a geographical area, for digital we need a wider scope.'

(Manager at a Digital Health Company)

Across all interviews, interoperability, and the need for integration of all the systems were recognized as the main contributors for why digital health services are still to succeed. Following Service Dominant Logic, value is co-created through the interaction between patients and providers in health care, involving an important exchange of information, and the management and analysis of the patients' information. Therefore, they need to be integrated and linked (Maglio & Spohrer, 2008).

Sub-categories	References
Promotion	11
Interoperability	10
Financing	9
Segmentation	7
Complementary Services	5
Digital Health	5
Health Literacy	5
Service Design	4
Centralized Health care System	4
Certifications	3
Solutions for Chronic Diseases	3
Team	3
Security Concerns	3

Table 7- Challenges

On the other hand, at the service level, several experts highlighted the importance of multidisciplinary service design teams, following the service design process and designing it from a patient-oriented perspective. These would help to design an efficient process, overcome structural impediments, align the benefits around patients' needs and expectations and hence, increase the likelihood of a successful solution.

'Then you also need to include all stakeholders in the design of such application.'

'Clearly the shift is patient oriented. This means starting from what the customer's needs are. The service has to make sense.'

(Manager of a Digital Health Company)

However, the challenge that seems to be the more relevant and urgent for the experts are the need for a better communication and promotion of digital health services. This is relevant for consumers since it will help address some misconceptions and social beliefs towards digital health. The starting point should be physicians and service providers.

'There is a lack of information. It's often taken for granted that the user has that information. I think a lot of times that stage is passed here.'

(Professor and Researcher)

Most of the experts pointed out that digital health services should be considered as complementary services of the traditional health care system. This means that both systems should be integrated and work together rather than being independent. Such integration will enhance the efficiency and facilitate patient health management. Additionally, the need for the development and design of a complete digital health service was stressed. Experts underlined the importance of having a carefully structured support system in case a technology stops working. Additionally, the service should include a channel with easy access to a human contact to solve certain problems. Such access is essential to avoid inefficient systems and anxiety.

Other challenges yet to overcome are the segmentation of solutions for different populations. The experts admitted room for improvement in personalized care, especially in the improvement of solutions for chronic diseases.

4.7   Social beliefs

Throughout the interviews the experts shared some of their experiences unleashing some of the customers social beliefs and attitudes towards digital health services. During the data analysis the social beliefs and trends of society in general were categorized as presented in table 10.

The role of time was verified to be an important factor when interacting with digital health services, when interacting with both the technology and the service. In the case of the interaction with the technology, experts believed that consumers are very sensitive to the usage time and therefore highly likely to abandon a system that takes too much time. On the other hand, regarding the interaction with the service age is an important variable to take into consideration. Older generations value time over money, valuing more the relationship with their medical doctor and the sense of being accompanied. For those individuals some negative personal beliefs towards telemedicine such as discrediting, and degrading were common.

Sub-categories	References
Value of Time	6

Feel Accompanied	3
Digital Trend	3
Free Health care	3
Lower Price for Digital Services	3
Trust in Technology	2
Telemedicine is Not Efficient	2

Table 8- Social Beliefs

'The elderly have a funny behavior which is: while we always live a hectic life; the elderly suffer from it. Because the time when you were with the doctor was the time of companionship as well. People miss the human contact.'

(Physician and Lead Medical Doctor)

On the other hand, tendentially younger generations prefer time over money, valuing the efficiency and the ability to easily incorporate their health management into their day-to-day life.

A more consensual view on how customers perceive the price of digital health services was observed. Managers draw attention to the fact that individuals are not used to paying for health services and that they often perceive digital services as less costly since there are no apparent physical costs.

'People are expecting to pay less for technology services because everything involves less costs. That is the perception of people. Transactions in the digital world in general feature lower volumes.'

(Manager of a Telemedicine Platform)

Regarding the trust and use of technology, the interviewees believe it be no longer an issue and that there is a digital trend growing naturally across industries and users.

4.8 COVID-19 effects

Across the interviews the changing framework caused by the pandemic Covid 19 was mentioned numerous times as it is possible to observe in figure 2.
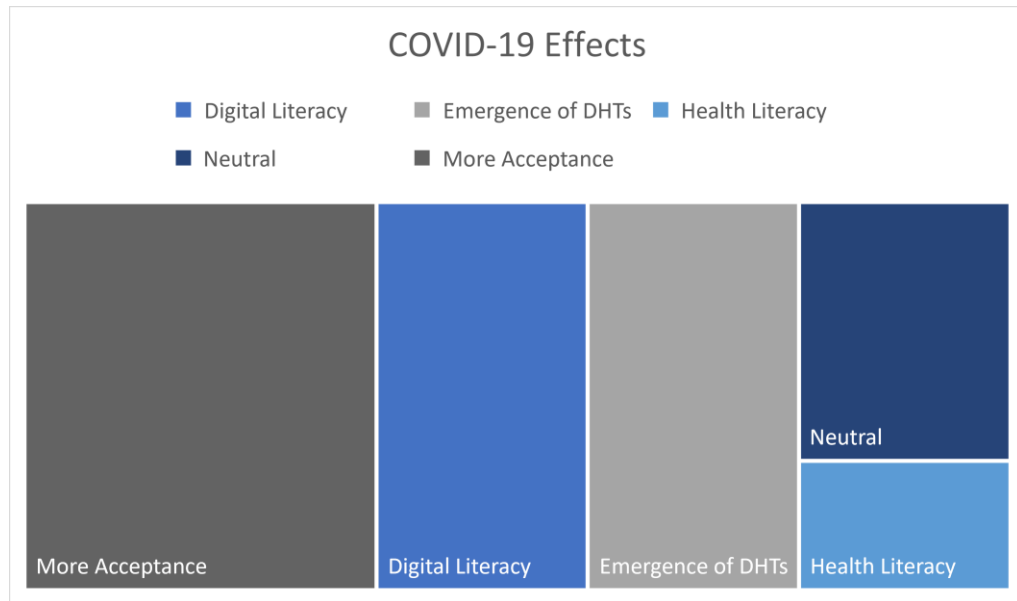
Figure 2- COVID effects (by the author)

Seven of the experts recognized that the pandemic had some sort of push effect to the acceptance of digital health.

'The technologies that came with the pandemic are here to stay. I think many technologies have even busted some myths about their performance in clinical settings. All clinical areas have been transformed. People have also increased their acceptance of the technologies.'

(Director of Information Systems Management at a Public Hospital)

However, the rest of the experts believe that even with the pandemic the acceptance of this type of services is rather low, or the advances made were temporary and the level of acceptance will go back to the scenario prior to the pandemic.

'We shouldn't be too optimistic about the advances made in digital health usage because of the pandemic. Progress is not guaranteed and often goes backwards. So, I'm reticent regarding what might happen.'

(Professor and Researcher)

On one hand, experts defended that from the customer side the higher adoption of digital technologies was motivated by the forcing of technologies in the health context caused by the pandemic outbreak. On the other hand, experts also recognized that from the service providers side, the emergence of new digital health services grew exponentially, hence, increasing the offerings available for consumers. Finally, some experts also mentioned that the COVID-19 had an impact on how individuals view their own health. Some referred that individuals became more aware and worried about their own health, habits and public health.

4.9 Risks

Sub-category	References
Desinformation	2
Anxiety	2
Digital Dependency	2
Professionalization	1
Cyber Security	2

Table 9- Risks

Even though during the interviews the experts were not directly questioned about the risks, 1/3 of them referred to at least one risk that digital health services were subject to. The main risks that were mentioned were disinformation which is associated with the amount of information available on the internet, the level of illiteracy and the challenge of a better communication and promotion of digital health services. Experts recognized a risk for individuals in the increase of digital dependency, data protection issues and anxiety related to their health management. Lastly, the emergence of immature technology was also pointed out as a factor that may damage the significant value of digital health.

'The challenge is to actually be useful and not cause false worry and anxiety.'

(Physician)

5 Discussion

Based on the previously presented results, this chapter provides a discussion oriented to the understanding of the findings regarding the perceptions given by experts of patients' changing beliefs, needs and responses towards digital health services and their drivers and barriers of use and adoption.

The categories discussed in the chapter 4 emerged naturally according to the questions and the structure of the interview. The script was thought to obtain insights about the most important topics that would help to address the research questions imposed in this study. This section explains how the categories and research questions are related.

The categories 'Factors', 'Added Value and Perceived Utility', 'COVID-Effects' and 'Medical Condition' help to understand the main drivers for the use and adoption of digital health services (RQ1). The categories 'Barriers', 'Factors and 'Social Beliefs' address the RQ2, finally the categories 'Challenges' 'User Friendly Characteristics', 'Risks 'address the RQ3.

The category 'Factors' 'Perceived utility and added value' address RQ1'. The category 'Factors' depicts the main external and internal factors affecting the use and adoption of these services. From this category it is possible to observe that internal factors were considerably more recognized than external factors. Among the internal factors and the 'Medical condition' category, the aspect that revealed to be the most crucial to consider is the individual's medical condition. Eight out of ten experts interviewed indicated that having a medical condition makes the individual more motivated to engage with digital health solutions due to their desire either to improve health management or live independently. In chapter 2, the literature review indicated that individuals with a medical condition feel more motivated to manage their health status (Liu et al., 2019). The most referred medical condition was the occurrence of some type of chronic disease.

Individuals from younger generations are more likely to interact with digital health technologies since they are more used to technology. Prior enriching experiences with technology and higher digital literacy, often associated, enhance the plausibility of interacting with digital health technologies. Such data goes in line with what was demonstrated in the literature review (Nutbeam, 2021; Wünderlich et al., 2013). On the other hand, bad experiences with traditional health care systems may also lead individuals to digital health solutions. The increasing promotion of healthier lifestyles is a socio-cultural factor that drives users to adopt digital technologies as a way to achieve their goals. Such substantiates the social influence variable explained in chapter 2. The individual traits are important characteristics that shape the individual intrinsic motivation to engage with digital health. The drivers identified in that scope were the desire to achieve a healthier lifestyle, the interest in being up to date with the latest technologies and the preference for solutions that provide a more accessible support to the health management. The value of time showed to be perceived differently among generations. Older people will easily exchange time for money, whereas younger individuals will more easily trade money for time. This finding was also driven by the category 'Social Beliefs'.

Concerning the external factors, the main ones identified were the efficiency brought by the technology and lower costs. Additionally, if the service or technology is recommended by someone of who an individual trusts, the individual will feel more motivated to adopt it. Situations and contexts in which an individual is left with no other choice were often mentioned to be a crucial factor for the push of the usage of such technologies. More than 2/3 of the experts referred to the example of the COVID-19 pandemic. Experts admitted that the pandemic

impacted the digital health usage through different ways. It created an incentive for more solutions to emerge, and at the same time patients felt more motivated to use technologies, overcoming therefore some misconceptions and myths about digital health. Marketing strategies also proved to influence cultural trends and therefore on the usage of digital health solutions.

The category 'Perceived utility and added value for the patient when using digital health services addresses RQ1 enlightening on the motivations behind the use and adoption of this services. Efficiency, convenience, and easy accessibility were understood by the experts as the most important added values and perceived utility identified. Accessing the right health services in a timely manner and at a lower cost from any location is a critical recognized outcome. Experts believed customers value the greater on their control and access on their own health data providing them therefore more autonomy such validates the sense of empowerment described in the literature review (Organization, 2018).

To address RQ2, the categories 'Barriers', 'Factors' and 'Social Beliefs' provide the key input. Similar to 'Factors', more internal than external barriers arose. In the category 'Factors', the data collected revealed that the elderly are less likely to adopt digital health technologies mainly due to two reasons: the diminished ability to interact with technology and the traditional relationship between physicians and the elderly. Both were pointed out preciously in literature as negative influences for the use digital health services acceptance. Health illiteracy represents a major problem in the Portuguese society and is an impediment to broader the adoption of digital technologies. Such insight was also captured of the category 'Social Beliefs'. The existing disinformation, and the incapacity of the customer to interpret and understand health data and the digital advantages are main drivers for lack of trust and negative personal beliefs towards digital health services. The lack of first adopters does not help regarding breaking the human nature of routine and habits towards the digital health which again validate the social influence variable discussed in chapter 2.3. The main external barriers identified were the lack of clear information for consumers and lack of access to the technology due to financial and political reasons. Experts also pointed out the fact that in general Portugal's population is not used to paying for health services and usually believes digital services should be cheaper than physical ones since they have a smaller cost structure. At a technological level, the lack of interoperability and complex portal interfaces represent critical barriers for a successful implementation.

Lastly, the category 'Challenges', 'Characteristics' and 'Risks' address RQ3. According to the experts, the biggest challenge digital health adoption faces is the need for a better communication and promotion of digital health services. At a macro level the study corroborated some challenges already identified in the literature, namely: lack of financial, political incentives, certifications, and regulations; to overcome health illiteracy, and to deal with data protection issues

In the category 'Characteristics', the experts' insights on the elements and aspects that should be considered for the design and development of a digital service were reunited. In line with the literature review, the technological characteristics identified to positively affect service acceptance are ease of use, simplicity, short usage time, clear information, the existence of desired information such as user's evaluation and data evolution, compatibility, role clarity and an appealing interface. At a service level, the study showed that the ability to have human contact by connecting patients to family, friends, and health care professionals is both useful and valued in digital health.

Additionally, the need for development and design of a complete digital health service was emphasized. Experts underlined the importance of having a structured support system in case a technology stops working. The service should include an easy access channel to a human contact to address certain problem. Experts stressed the need to have a multidisciplinary service design team, follow the service design process and design it from a patient-oriented perspective following the service design process stressed in chapter 2.2.

Another challenge is to integrate digital health services as complementary services of the traditional health care system, hence, enhancing the efficiency and facilitating the patient health management. Concerning the personalized care, experts recognized the lack of complete solutions. Digital health services still fail to succeed on solutions for chronic diseases and to customized for different specific populations.

6 Conclusion, recommendations, and future research

The COVID-19 pandemic changed the way health care is delivered and the way users and patients perceive digital health services. The changing context and the demonstrated importance of the need for real-time information sharing and fast decision-making have been boosters for the shift towards digital solutions demonstrating that digital health has come to stay.

This study by analysing the experts' insights of the users' perceptions in the post pandemic times gives an updated validation of the literature regarding the main drivers and barriers of users' adoption and use of digital health services. Additionally, the study provides information regarding the challenges that digital health faces and suggestions of how to overcome them.

Regarding the RQ1, the findings showed that individuals will feel more motivated to engage with digital health when they have a medical condition. The user's ability to use digital technology, usually related to the age of the individual and previous experience with technology often dictate their predisposition towards digital health solutions. The social trends and marketing for a healthier lifestyle open a window for the adoption and use of these solutions, making it easier for individual with these healthy lifestyle goals to achieve it in a more efficient way. The findings of this study emphasize the importance of word-of mouth to prompt the adoption of these solutions. Experts acknowledged that the pandemic impacted digital health usage through a variety of ways, not only making more room for new service providers and solutions to emerge, but also by overcoming some misconceptions and myths about digital health by making patients use these technologies. For users, digital health care can facilitate better health self-management, timely and appropriate medical services that can be accessed when needed in a more reliable way.

Regarding the RQ2, the data collected revealed that the main barriers are related to illiteracy, namely: digital and health illiteracy, making digital health services less available for the elderly, who are already less prone to using them due to the traditional relationship with physicians. The lack of clear information about digital health advantages and the incapacity of the customer to interpret and understand health data are main factors for lack of trust and negative personal beliefs towards digital health services. Additionally, the general Portuguese' population is, in general, not used to pay for health services and usually believe digital services should be cheaper than physical ones since they have a lower cost structure. Hence, individuals are very price sensitive.

The last research question, RQ3, is concerning the main challenges that digital health has yet to face. One of the main contributions for this study was the revealing urgency for a better communication and promotion of digital health's value. Additionally, this study stressed the need to overcome health illiteracy and health disparities. At a macro guidance level, it lacks regulation, certifications, and financial and political incentives. At the design and development level, there is a need to have a multidisciplinary service design team, following a service design process and design it from a patient-oriented perspective. At a technological level, some insights were collected regarding which elements and aspects should be considered for the design and development of a digital service. The need for interoperability and a simple interface throughout the system represent critical elements for a successful technology. At a service level, the study showed that the ability to have human contact by connecting patients to family, friends, and health care professionals is both useful and valued in digital health.

The study findings offer several strategic implications for the health-related service industry. Managers must define a good payment model for customers to be able to offer an affordable

and competitive service. They must build the capabilities and incentives of the provider workforce to support virtual care (for example, workflow design, centralized scheduling, and continuing education) such will be able to create a complete service with complementary services.

Managers must also take in consideration that the future of health care can only succeed if the design of the service integrates the traditional health care providers, new players from the fields of technology and customers as co-creators of health care experiences. It is imperative to integrate individuals with strong medical and clinical capabilities, an understanding of the underlying disease and treatment paradigms, and an ability to navigate the health care landscape. It is necessary to create scalable and centralized models following the service design process based on a deep understanding of the person's context and motivations, the delivering company or organization and market strategies. The study of the drivers and objectives of users are key to support the design and development of these services.

There is a need for policy makers to create clear and more aligned incentives for digital health activities with the broader movement toward value-based care and measure the value of virtual care by quantifying clinical outcomes, access improvement, and patient/provider satisfaction. Although health care systems tackle this issue to extent the benefits of technological advancements to all users, the service redesign should be oriented by processes of segmentation that will ideally result in a more tailored response to everyone's needs through a combination of traditional and digital solutions.

Finally, physicians should integrate the use of digital technologies in their clinical practice. Patients must have more autonomy and responsibility. There should be a common effort to prepare patients for the use of digital health solutions through education and trustful recommendations.

Although the results of the current study have shed light on several important issues, some limitations need to be considered in future research, such as the study of the drivers of customers adoption and use for each type of digital health technology and the inclusion of the patient's perspective using the patients and users' testimony. The use of experts' testimony to construct the users' perceptions is recognized as limitation to this study. Future research may use surveys to measure, from a demand-side perspective, the value created for customers and the society through the different types of digital health. The future evolution such as the incorporation of virtual reality in the management of pain, and further advantages that these technologies entail, in addition to those already listed, could be the subject of future management studies.

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APPENDIX A: Interview Script

Interview script

I would like to thank you for your availability to collaborate in this interview and to share your knowledge about the digital health theme.

As a brief introduction, I am a student of the service engineering and management master's degree of FEUP and I am doing my dissertation in partnership with FEUP and INESC TEC. The topic of my dissertation is "Drivers of customers' adoption and use in digital health services: an exploratory study". In this sense, I am collecting information and experiences of experts in the field regarding this theme. Before we move on, I would like to ask for your consent to record the interview, and if you have any questions, please do not hesitate to ask.

Given today's reality, new models of health care, namely digital health, are increasingly relevant and constantly expanding. The potential of this area is not only based on technological developments but also on the consideration of the human factor. The adoption and use of these technologies is marked by the stakeholders' ability to mold themselves to the expectations and needs of their users.

1.   What factors (external and internal) do you think drive users to adopt and use digital health solutions?

2.   What is the utility and added value offered to the user in these solutions?

3.   What features do you think make these technologies easy to use/"user friendly"?

4.   What are the biggest user barriers in using these services?

5.   What do you see as the biggest challenges (short and medium-long term) for these types of services?

I would like to thank you in advance for your collaboration.