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Rui Pedro Salgueiro Caceiro

TELEHEALTH IN PORTUGAL

CURRENT STATE AND PHYSICIANS' SATISFACTION

Dissertação no âmbito do Mestrado em Gestão e Economia da Saúde orientada pelo Professor Doutor Pedro Lopes Ferreira e apresentada à Faculdade de Economia da Universidade de Coimbra.

Setembro de 2022

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à Faculdade de Economia da Universidade de Coimbra para obtenção

do grau de Mestre

Orientador: Prof. Doutor Pedro Lopes Ferreira

Coimbra, Setembro de 2022

À minha noiva Catarina

Aos meus pais

À minha Avó Graciete

A todos os que contribuíram para o meu sucesso

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Index

Resumo

A Telessaúde constitui um elo importante na prestação de cuidados de saúde, sobretudo, após a pandemia de COVID-19. Como resultado da atual revolução digital, os sistemas de saúde têm agora à sua disposição novas soluções informáticas que prometem melhorar a produtividade das equipas, a gestão de recursos e a promoção de um acesso mais justo e universal aos cuidados de saúde. A avaliação, regulamentação e reavaliação frequente são necessárias para a conceção, desenvolvimento e aplicação destas tecnologias, especificamente através da avaliação de indicadores dos serviços de saúde e de inquéritos aos profissionais de saúde. O objetivo deste estudo é caracterizar o estado atual da telessaúde portuguesa e a satisfação dos médicos portugueses.

Foi realizada uma pesquisa exaustiva da literatura sobre instrumentos de medição validados para a avaliação da satisfação dos médicos com telessaúde. Após a identificação de 14 questionários, o Telehealth Usability Questionnaire (TUQ) foi considerado o mais aplicável e traduzido para o português europeu. Foi realizado um estudo transversal analítico com base num questionário online dirigido aos médicos inscritos na Ordem dos Médicos entre agosto e setembro de 2022. Foi realizada análises descritiva das variáveis mais pertinentes. Posteriormente, testes *t-student* para amostras independentes e análises de variância ANOVA, com posterior teste post-hoc de Scheffe para avaliar os fatores de influência sobre as variáveis. Para o inquérito traduzido, foi realizado um teste de consistência interna alfa de Cronbach.

Participaram no estudo 1010 médicos (idade média = 47,33 anos, 58% do sexo feminino). A tradução do TUQ apresentou um alfa de Cronbach de 0,873. A telessaúde fez parte da prática diária de 55,1% de médicos, embora 71,2% tenham mencionado ter realizado pelo menos uma teleconsulta nos últimos 6 meses. A chamada telefónica foi o método mais utilizado (74,5%), já que a videoconsulta só foi realizada por 24,5% dos médicos. O correio eletrónico foi o método mais frequentemente utilizado para enviar ou receber documentação e o gabinete de consulta comum o espaço mais frequente para a teleconsulta. Quanto às opiniões dos médicos, apenas 13,9% concordaram com as primeiras consultas à distância, enquanto 75,8% concordaram com as teleconsultas de

acompanhamento, enquanto 59,5% demoraram menos tempo do que nas teleconsultas presenciais. A dificuldade técnica mais frequente foi a falta de tecnologias de informação adaptadas, enquanto a dificuldade clínica foi a incapacidade de realizar o exame objetivo.

No que diz respeito à avaliação dos níveis de satisfação, os médicos que trabalham exclusivamente no sistema público reportaram valores mais baixos de conveniência para o doente (F=13,909; *p-value* <0,001) e para o médico (F=3,403; *p-value* = 0,034), "Qualidade e satisfação do utilizador" (F=14,289; *p-value* <0,001), "Usabilidade e utilização futura" (F=3,678; *p-value* <0,026) e "Fiabilidade" (F=16,025; *p-value* <0,001), quando comparados com o sistema privado. As especialidades médicas pontuaram mais em termos de Utilidade e utilização futura (*t-value* 2,513, *p-value* = 0,012).

Em tempos pós-pandémicos, a telessaúde parece ter mantido níveis elevados de utilização, confirmando o seu potencial e aceitação geral. Contudo, ainda existem dificuldades importantes ao nível clínico, tecnológico, institucional e jurídico. Este estudo reuniu informações importantes para orientar as instituições de saúde e as autoridades reguladoras no sentido de desenvolver infraestruturas e estabelecer regulamentos a fim de potenciar a utilização racional e eficaz da Telessaúde.

Palavras-chave: “Telemedicina”; “Satisfação laboral”; “Portugal”; “Inquéritos e questionários”; “Tecnologia digital”

Abstract

Telehealth has become extremely significant in the delivery of healthcare. As a result of the present digital revolution, health systems now have new information technology solutions at their disposal that promise to improve team productivity, resource management and the promotion of more fair and universal access to healthcare. Evaluation, regulation and frequent reassessment are required for the conception, development and application of these technologies, specifically through the evaluation of indicators of healthcare services and surveys of healthcare professionals.

It was aimed to characterize current portuguese telehealth state and physicians' satisfaction.

Based on a thorough scoping assessment of pertinent papers, a comprehensive evaluation of the literature on validated measuring tools for telehealth satisfaction was conducted. After identifying 14 questionnaires, Telehealth Usability Questionnaire (TUQ) was considered the most applicable one and translated into European portuguese. A cross-sectional observational research based on a survey was conducted to assess the current state of Portuguese telehealth and the satisfaction of physicians who are members of the Portuguese medical organization. Additionally, sociodemographic characteristics and employment status were considered. Independent sample t-student test and ANOVA variance analyses with the Scheffe's post hoc tests were then used to assess the influence factors on the variables. For the translated survey, a Cronbach's alpha internal consistency test was performed.

Participated in the study 1010 physicians (mean age = 47,33 years, 58% female). TUQ translation presented with a Cronbach's alpha of 0,873. Telehealth was a part of the daily practice of 55,1% physicians, although 71,2% mentioned to have performed at least one teleconsultation in the last 6 months. Phone call was the most used method (74,5%), as videoconsultation was only performed by 24,5% of doctors. E-mail was the most frequently used method to send or receive documentation and regular consultation room the most frequent space for telehealth. Regarding physicians' opinions, only 13,9% agreed with first time remote consultations, while 75,8% agreed with follow-up teleconsultations, while

59,5% took less time than in-face teleconsultations. The most frequent technical issue was the lack of adapted information technologies while the most clinical difficulty was the inability to accomplish physical examination.

Regarding satisfaction questionnaires highlights, doctors working exclusively on public system ranked with lower values of perceived telehealth convenience for both patient (F=13,909; p-value=<0,001) and doctor (F=3,403; p-value=0,034), “Quality and user satisfaction” (F=14,289; p-value=<0,001), “Usability and future use” (F=3,678; p-value=<0,026) and “Reliability” (F=16,025; p-value=<0,001), when compared to private system. Medical specialties scored higher in usefulness and future use rates.

In post pandemic times, telehealth seems to have maintained high usage scores, confirming its potential and general acceptance. However, there are still important issues to address at the clinical, technological, institutional, and legal fields. This study gathered important information to guide health institutions and regulatory authorities to develop infrastructure and establish regulations in order to potentiate Telehealth rational and effective use.

Keywords: Telemedicine; "Job Satisfaction”; “Portugal”; "Surveys and Questionnaires", “Digital technology”.

Lists of acronyms, abbreviations, symbols

CHUC – Centro Hospitalar e Universitário de Coimbra

CI – Confidence Intervals

CIRM – Centro Internazionale di radiocomunicazione Mediche

CNTS – Centro Nacional de TeleSaúde

CSQ – Client Satisfaction Questionnaire

CVDs – Cardiovascular diseases

DGS – General Directorate of Health

EC – European Commission

ECLAC – Economic Commission for Latin American Countries

e-HIQ – e-Health Impact Questionnaire

eHDSI – e-Health Digital Service Infrastructure

eHR – Eletronic health records

EOHSP – European Observatory on Health Systems and Policies

ER – Emergency Room

EU – European Union

GDP – Gross Domestic Product

GDRP – General Data Protection Regulation

HHS – U.S. Department of Health and Human Services

HIPAA – Health Insurance Portability and Accountability Act

IBM – International Business Machines Corporations

ICT – Information and Communication Technology

IoT – Internet of Things

MAUQ – mHealth App Usability Questionnaire

MS – Member State

PACT – Patient Assessment of Communication during Telemedicine

PALOP – Portuguese- speaking African Countries

PCPs – Primary care physicians

PENTS – National Strategic Plan for Telehealth

PRISMA – Preferred Reporting Items for Systematic Reviews and Metanalysis

PSQ – Patient Satisfaction Questionnaire

PSSUQ – Post-Study System Usability Questionnaire

QUIS – Questionnaire for User Interface Satisfaction

SEA - Southeast Asia

SPMS - Shared Services of the Ministry of Health

SUS - System Usability Scale

SUTAQ – service User Technology Acceptability Questionnaire

TAM – Technology Acceptance Model

TH – Telehealth

TSQ – Telehealth Satisfaction Questionnaire

TSUQ – Telemedicine Satisfaction and Usefulness Questionnaire

TUQ – Telehealth usability questionnaire

USEQ – User Satisfaction Evaluation Questionnaire

WHO – World Health Organization

Lists of tables

Lists of figures

1. Introduction

The current definition of health provided by the World Health Organization (WHO) is that it is "a state of complete physical, mental and social well-being and not only the absence of disease or infirmity". (World Health Organization, 1946) But, even though this definition is widely accepted, healthcare has undergone substantial changes over time, much of which may be linked to the cultural shifts and events that have occurred in certain civilizations.

At first, religion had a significant impact on one's health since it was associated with winning the divine's favor. People were forced to rely on religious healers who defended the necessity for prayer and sacrifice to seek cure because there was no other explanation for Health and Disease, for Birth and Death. (Sigerist, 1987) In reality, this was not only a health concern; everything that was invisible was attributed to mystical causes. Ancient communities justified the lack of food, poverty, bad luck, natural disasters, or other calamities with the deities' displeasure. For instance, in ancient Greece, persons seeking healing would travel to the temples of angered deities around order to placate their fury, such as the temple of Asclepius, the Greek divine healer. This definition for health and healthcare is eternized in the Rod of Asclepius, widely used as the symbol of Medicine, as a reminder of humanity's long-held belief that health was conferred by gods. (Young et al., 2013)

Around the fifth century before Christ, Hippocrates, the father of modern medicine, made the first significant departure from mystical conceptions of health. Hippocratic school propose that disorders of the four physiological fluids - black bile, yellow bile, phlegm and blood - caused sickness. (Santacroce et al., 2017) Consequently, Hippocratic medicine was the first to define health as a condition of bodily balance that could be attained via a combination of behavioral and therapeutic measures. (Marketos & Skiadas, 1999; Orfanos, 2007) A few centuries later, the roman Galen contributed to the growth of a more comprehensive view of health-body balance that considered the whole patient whole, including their mental and emotional state. (Cruse, 1999; West, 2014)

As is well known, further scientifical, anatomic and physiological discoveries about the cell, microorganisms, genes between others created the modern notion of Health and Medicine.

Just like the concept of Health, the practice of Medicine as well as its purposes have evolved significantly for a variety of reasons.

Firstly, the concept of healthcare being a duty of the healer, carried out by religious people seeking to appease the gods' wrath in religious temples was progressively defeated by a much rational notion. After the Renaissance, driven by the Enlightenment movement, started the roots of the scientific method, in the early, seventeenth century. A growing and zealous scientifical community started providing the groundwork for our current medical practice. It is important to recall the names of Paracelsus, the scientist that brough Chemistry into Medicine, Robert Koch, which discover the basis of our Microbiology, Edward Jenner, which created the Pox vaccine, among many other important names. A major shift in the understanding of antibiotics and the control of infectious diseases was also facilitated by Alexander Fleming's 1928 accidental discovery of Penicillium Notatum's anti-bacterial properties. Science brought to Medicine the knowledge needed to diagnose and treat patients correctly. The growth of academic medicine in Europe, particularly at Bologna, Padua, Paris, Montpellier and Oxford, also contributed to changes in medical practice. (Cruse, 1999; Tulchinsky & Varavikova, 2014)

Additionally, technology developments also enabled by science have been adapted to medical practice to improve medical outcomes, such as the development of diagnostic tools like the stethoscope, by René Laennec, in 1814, the invention of x-ray imaging, by the German physicist Wilhelm Conrad Röntgen, in 1895 or the invention of the microscope by Leeuwenhoek, a Dutch scientist and draper, in 1674. (David & Dumitrascu, 2017; Lavine, 2012; Wollman et al., 2015)

A long enumeration of not directly health-related improvements such as the creation sanitization and potable water delivery systems, as well as the discovery and widespread use of electricity, the advancement of transportation, the advancements in population education, among others must also be mentioned

because they also changed healthcare paradigm. (Cristea et al., 2020; Tulchinsky & Varavikova, 2014)

In fact, all the mentioned factors combined enabled the average life expectancy to rise from 25 to 30 years, in pre-historic times (with males lived longer than women for reasons probably related to starvation and pregnancy) to more than 80 years in the high-income countries (where women live longer than man). (Crimmins, 2015; Tulchinsky & Varavikova, 2014)

Given the many advances in science, technology and culture that have occurred throughout the last millennia, the current most accepted definition of medical practice consists in "an organized consulting occupation which may serve as the discoverer, carrier and practitioner of certain kinds of knowledge". It is the duty of interdisciplinary team within institutions that interact with one another and are, typically, governed and funded by the legislators of the nations in which they operate, regardless of the patient's religious beliefs, if that is the case. (Freidson, 1988) However, with this advancement come new difficulties, such as an aging population and the rise in the prevalence of chronic diseases, which causes undoubtedly an increase in the resource consumption in healthcare. All the previous in the context of a European and Global financial downturn, demanding both a reduction in cost and a boost in effectiveness in this field. (Callahan, 1996; Cristea et al., 2020)

As a conclusion to these initial paragraphs, we should acknowledge that the healthcare field has undergone significant structural and conceptual changes through time and that our present understanding of health and medical practice is not set in stone. As societies adapt to new discoveries and developments or are exposed to events such as conflicts, natural disasters, or pandemics (and their short- and long-term effects), the concepts of health, medical practice and healthcare system will invariably change, adapt and evolve.

The search for the ideal healthcare system

The vast majority of international policymakers concur that the ideal healthcare systems should strive for universal access for all citizens, utilizing an efficient use of human and non-human resources to provide high-quality services

and responsiveness to the population's concerns and requirements. Although there is a strong consensus on a strictly theoretical level, decision-makers often take different ways - a fact that is not unique to the health sector. It is reasonable to conclude that none of these strategies has been entirely effective and that no country consistently satisfies the WHO definition of Health. Within its various configurations, every health system configuration has advantages and disadvantages of its own. (Saltman et al., 2007)

However, the achievement of the universal access postulate is hindered by unequal access to healthcare, present in every country. As health is a fundamental human right, World Health Organization (WHO) consider that health equity is only achieved when “everyone can attain their full potential for health and well-being". (Office of the United Nations High Commissioner for Human Rights, 2008; WHO, 2021) In fact, globally, 1.3 billion people do not have access to high-quality, affordable healthcare, while an additional 1.7 billion individuals spend at least 40% of their family income on healthcare. (Gilardino et al., 2022)

Most of the health systems fail to achieve equity because of various factors. For instance, in certain countries, societal problems like racism hinder the treatment of some patients. Some low-income nations and even some high-income countries with unequal healthcare funding systems may fail to provide the acceptable healthcare services to the poorer inhabitants. Moreover, every territory has an uneven distribution of people, workers and population over its land, which inevitably results in an unequal distribution of resources, including medical resources. (Myers et al., 2008) For instance, for many reasons, such as the historical connection of the country to the sea, between others, Portugal demographic distribution shows a clear concentration of population by the shore, while the in-land territories are left empty. This leads to unequal labor productivity rates, capital and, because of that, resources. Concluding, inequality in healthcare may thus also be significantly influenced by geographic and demographic factors. (Oliveira & Bevan, 2003)

Efficiency should be the second pillar of the perfect healthcare system. However, health systems tend to be the opposite, consisting in heavy, complex and inflexible entities, prone to inefficiency. At the same time, the expense of healthcare is substantial and will continue to climb. (Foreman et al., 2018; Goryakin et

al., 2020) For instance, it might be quite challenging to manage a huge healthcare workforce that typically is highly differentiated and needs to be appropriately compensated. On the other hand, there are countless illnesses that call for an infinite number of diagnostic tools or treatments, while medicines, medical equipment and other healthcare supplies can often be highly pricey and swiftly deteriorated. (Cylus et al., 2016) Scientifical progression will continue to develop incredible new treatments or technological solutions. Though the cost of research and development is considerable, the cost of these solutions will also be hefty. (Barati & Fariditavana, 2019)

Additionally, by the end of the decade, 1.5 billion people older than 60 are estimated to live on this planet and 2.1 billion by 2050. Just as previously said, an extra strain on the healthcare system will result from the rising prevalence of chronic illnesses brought on by the aging population. (EU, 2020; UNITED NATIONS, 2022)

In order to overcome the declared obstacles to the achievement of the ideal healthcare system, healthcare governance must be developed through interdisciplinary collaboration (without ignoring citizen involvement - the patient is at the core of healthcare delivery systems) and based in adaptive policies, resilient structures and foresight. Several new reform ideas for health care on both an organizational and technical level, should be undertaken. For example, in order to control healthcare expenses' rise, evidence-based economic evaluations should be conducted. Public health initiatives include enhancing primary, secondary and primordial prevention measures should be reinforced to reduce preventable diseases. Another effective tactic may be to raise patient literacy. (Abel, 2008; Castleden et al., 2011; Eichler et al., 2009)

Digital transformation also pledges to be an interesting solution to improve healthcare systems outcomes. There is no denying that the technological revolution has affected every area of knowledge and activity. Over the past 50 years, information systems have become essential to society's functioning, which is now reliant on them. Particularly in healthcare, these systems are itself already an essential operational, strategic and functional tool. (Sheikh et al., 2021)

Between the different healthcare digital solutions, Telehealth pledges to be a potential option for assisting health systems in achieving universal access and

increased efficacy. Information and communication technology allow for remote medical practice, including providing medical advice, diagnosing patients and even providing therapy (medical, surgical). Physical barriers and distances could be eliminated by technologies, allowing wider access to healthcare at potentially lower costs. (Adriano Moran & Roudsari, 2015)

In the following subchapter, Telehealth, Telemedicine and other relevant concepts under the scope of the Digital Health will be presented and clarified their differences, to eliminate any doubts from the reader's mind. This will serve as the starting point for a subsequent reflection on the opportunities, disadvantages barriers to the implementation of Telehealth and to further discuss the ongoing and future applications of telehealth.

1.1 Telehealth – definitions, evolution and the current State-of-the-Art

1.1.1 Telehealth and related concepts

According to the WHO, “Telemedicine can be defined as “The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities”. (WHO, 2010)

Until recently, the only concept regarding providing treatment remotely was telemedicine. It is now solely regarded as a subset of the broader topic of "Digital health." This idea can be summed up as the application of digital technologies to improve one's health. (Ronquillo et al., 2022) With the use of health technology for nursing, patient education and other objectives in addition to medical practice, e-Health and Telehealth were coined, both under the broader umbrella term – Digital Health. However, recent studies have shown that the Telemedicine, e-Health and Telehealth are being used interchangeably and in a somewhat ambiguous way. Additionally, other relevant concepts have been presented under the scope of digital health: “mobile health" (mHealth) – the use of mobile wireless technologies

for health - or the application of computer science to the improvement of healthcare systems like “Artificial intelligence” or “Big data” (Juzwishin, 2019).

Additionally, numerous new terminologies have been created as a result of the integration of telemedicine into different medical specialties, including teledermatology, teleradiology, telesurgery and telepsychiatry, between others.

The terminology used in the context of digital health, are succinctly defined in Table 1 and its hierarchy in figure 1.

In addition, Telehealth (TH) can be either synchronous (where the patient and the doctor create a real-time remote connection) or asynchronous (where all doctor-patient and doctor-to-doctor exchanges are postponed and do not require a real-time connection). Asynchronous telehealth allows medical professionals to save their most valuable resource: time. Some examples are secure messaging or email platforms. Providers can do online visits whenever it works into their schedule, such as between in-office visits or after hours, as there is no scheduling required, which can obviously increase productivity, patient and provider levels of satisfaction and have the potential to cut costs.

Concept	Definition
Digital Health	The use of digital technologies applied for health
eHealth	The delivery or enhancement of health services through the information technologies
mHealth	The use of mobile wireless technologies (such as cell phones) for health.
Telehealth	The delivery of healthcare involving telecommunications and virtual technology, outside traditional facilities.
Telemedicine	The delivery of medical care involving telecommunications and virtual technology
Big Data	A collection of data that is enormous in volume and growing exponentially with time, such as health related data
Artificial Intelligence	The application of machine learning (ML) algorithms and other cognitive technologies in healthcare settings
Electronic healthcare record (EHR)	Electronic record that securely holds information or data regarding patient’s health history, medication and care received.

Table 1 - Definition of the main digital health related terms

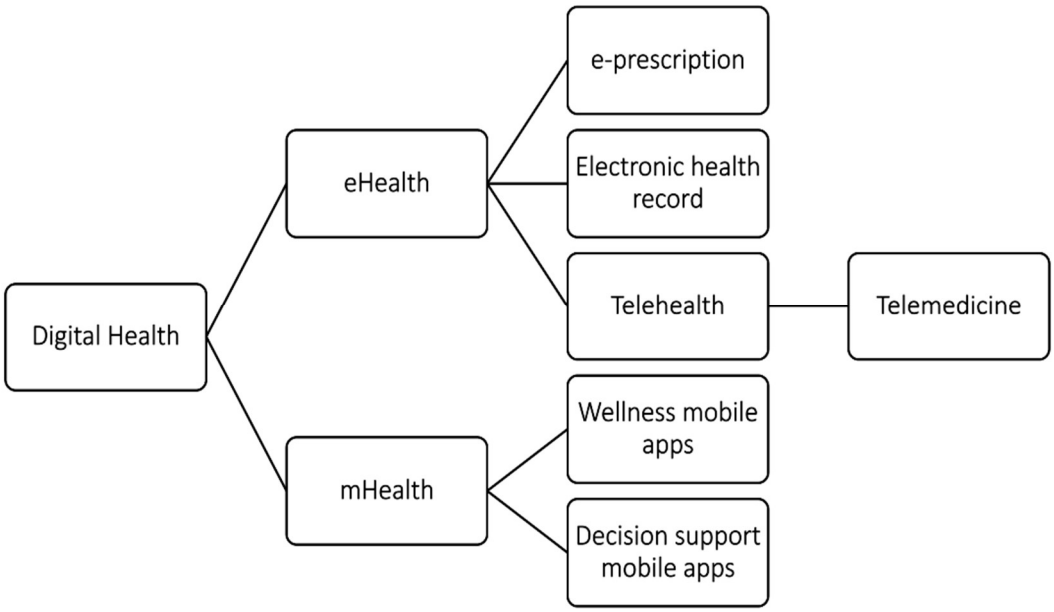

Figure 1 - Hierarchy on digital health related concepts

Another important modality of telehealth is Telemonitoring - the direct communication of physiological data, such heart rate, blood pressure or symptoms scores to the healthcare provider.

After providing a brief overview of the principles relating to digital health, it would be helpful for me to discuss the development of TH from the beginnings of its history to the latter advancements facilitated by the pandemics.

1.1.2 The history and development of Telehealth

This subchapter will include a brief summary of the significant events and developments related to the creation of the Telehealth state-of-the-art that we attained today. This description cannot be separated from each era historical, sociocultural and technological developments.

The first tool used to deliver remote medical treatment was the telegraph, commonly known as "The Victorian Internet." (Standage, 2007) For instance, there are records of the telegraph being used to communicate information about injured

soldiers to medical teams during the British Civil War in the 1860s. (Jagarapu & Savani, 2021)

For some decades, the only available remote communication was the telegraph, until radio became widely used popular technology and the principal mean of communication, in the early 20s. Since radio was transforming every industry, from entertainment to national security, it didn't take long until inventors began fantasizing about using it to provide healthcare services. (Jagarapu & Savani, 2021) An example of this enthusiasm was a cartoon titled "The Radio Doctor - Maybe!", published in the April 1924, issue of Radio News Magazine. It depicted a sophisticated medical technology that allowed a doctor to consult with a young patient over radio in order to evaluate and treat him. (Vladzymyrskyy & Jordanova, 2018) Radio was firstly used for providing medical care to ship crews. Apart from other amateur similar initiatives, the International Medical Radio Centre (Centro Internazionale di Radiocomunicazione Mediche, or CIRM) was the first official entity created in order to provide remote medical aid to seaship crews and island residents. It was founded in Italy by Professor Guido Guida, in 1935. (Guida, 1968) With more than 80,000 patients and 500,000 medical consultations, CIRM is the world's oldest organization still in operation that offers radio-medical assistance. (Mahdi & Amenta, 2016)

Although it already existed in the early 20th century, telephone lines were only used to transmit clinical files or images between the 40s and the 50s. Precisely in 1950, Gerson Cohen published a three-year experience of transmission of radiographs via commercial telephone lines between a local hospital and a county hospital located 60 miles away, coining a new term, “Telognosis” – today’s teleradiology. (GERSHON-COHEN & COOLEY, 1950) Additionally, in 1958, Briskier reported the first transatlantic telephone-mediated medical data transmission, which involved sending heart sounds and clinical data from New York to Rome and Paris. (Briskier, 1959)

Figure 2 - At left, "The radio doctor - maybe", published 1924. (Ramos, 2010) *At right, Professor Guido Guida at CIRM headquarters.(Dumanskyy & Bladzzymyrskyy, 2013)*

Later in this century, “Video killed the Radio star” and Television has become the new telemedicine trump as it has become increasingly popular and widely spread. Television gain uses not only on entertainment, but also in clinical care, medical education and surgical procedure demonstrations (like the "Blue baby operation”, performed at Johns Hopkins Hospital by Dr. Alfred Blalock and broadcast to hundreds of surgeons). (Jagarapu & Savani, 2021)

The concept of "Telemedicine" was just first used in 1971 by Thomas Bird, who defined it as "the practice of medicine without the conventional physician-patient confrontation using an interactive audio-video communications system”. (H Murphy & Kenneth Bird, 1971) This was after more than a century of successful remote medical care operations. For instance, the concept "Information Technologies" wasn't initially used until 1958 and Sir Tim-Berners Lee only created the World Wide Web in 1989. (Grech, 2001; Leavitt & Whisler, 1958) We can conclude that the concept of "Telemedicine" has emerged as part of the information technology revolution.

At the beginning of the new millennium, the first telesurgery occurred, in September 2001 - a surgical team from New York successfully operated on a 68-year-old woman with gallbladder disease in a hospital in Eastern France, using robotic-assisted laparoscopic surgery. (Choi et al., 2018) Another innovation from this decade was telementoring, which successfully allowed experienced physicians to supervise actual procedures taking place on the diametrically opposite side of the world.

Figure 3 - At left, the "Blue baby operation", performed at Johns Hopkins Hospital by Dr. Alfred Blalock and broadcasted by television.(Johns Hopkins University, 2019) *At right, images recording first telesurgery in 2001, between Paris and New York.* (Marescaux et al., 2001)

Telemedicine has grown tremendously quickly - even exponentially - over the past 20 years, supported by recent technology and software development. Rapid technological advancements in hardware (smart phones, tablets, telemedicine devices), software (mobile applications) and connection (cellular, broadband) have characterized these two decades. Numerous telemedicine tools and accessories have been created to provide remote care. Busing direct-to-consumer business models have developed, such as Teladoc in the USA or Knokcare in Portugal.

Finally, recently, COVID-19 pandemic gave telemedicine a huge boost, as it was, unfortunately, the perfect scenario for this development. The primary goal of telemedicine was to minimize interpersonal contact in order to reduce the risk of cross-contamination and the spread of viruses. However, teleconsultation's other objective is to keep giving patients medical assistance, whether patient was infected or not. (Hollander & Carr, 2020a) This step-change was propelled by necessity, but eventually caused a better consumer and provider acceptance of telemedicine and triggering regulatory reforms facilitating greater access and funding, in some countries. (Lord Ferguson et al., 2022; Pogorzelska & Chlabicz, 2022) Telemedicine provided a bridge to care during the pandemic's tragedy and it now presents an opportunity to rethink virtual and hybrid virtual/in-person care models with the aim of enhancing healthcare access, outcomes and affordability.

While telemedicine has advanced significantly over the past two decades, future decades could see even greater advancements. With the rise of

smartphones, wearable technology or even internet-connected home appliances, IT left the realm of computers and created a new age known as the Internet of Things (IoT). (Kamal et al., 2020) Ultrafast connectivity will allow a wide range of medical devices and equipment to be connected to a server, so that a big load of real-time medical data could be utilized by telemedicine technology to enable higher-quality remote treatment. (Suciu et al., 2015) Patients can check their blood pressure, temperature and heart rate at home using wearables and other medical equipment, sending that information to their doctor for review. This high degree of surveillance may potentially assist people with chronic diseases better manage their own health by reducing the need for urgent care and ER visits. (Champagne-Langabeer et al., 2019; Corbett et al., 2020; Mileski et al., 2017; Shah et al., 2016) From a different angle, healthcare data is vast (about 30% of the total volume of data in the globe), exceptionally huge for traditional technology. Big Data and artificial intelligence-based solutions are starting to take shape and they will be fundamental in addressing this issue. (Comission, 2020; Juzwishin, 2019; Kadadi et al., 2014; Lysaght et al., 2019) Finally, as younger generations get older and become more accustomed to using digital technology, telemedicine will become more widely accepted as a way to help older patients manage their chronic illnesses.

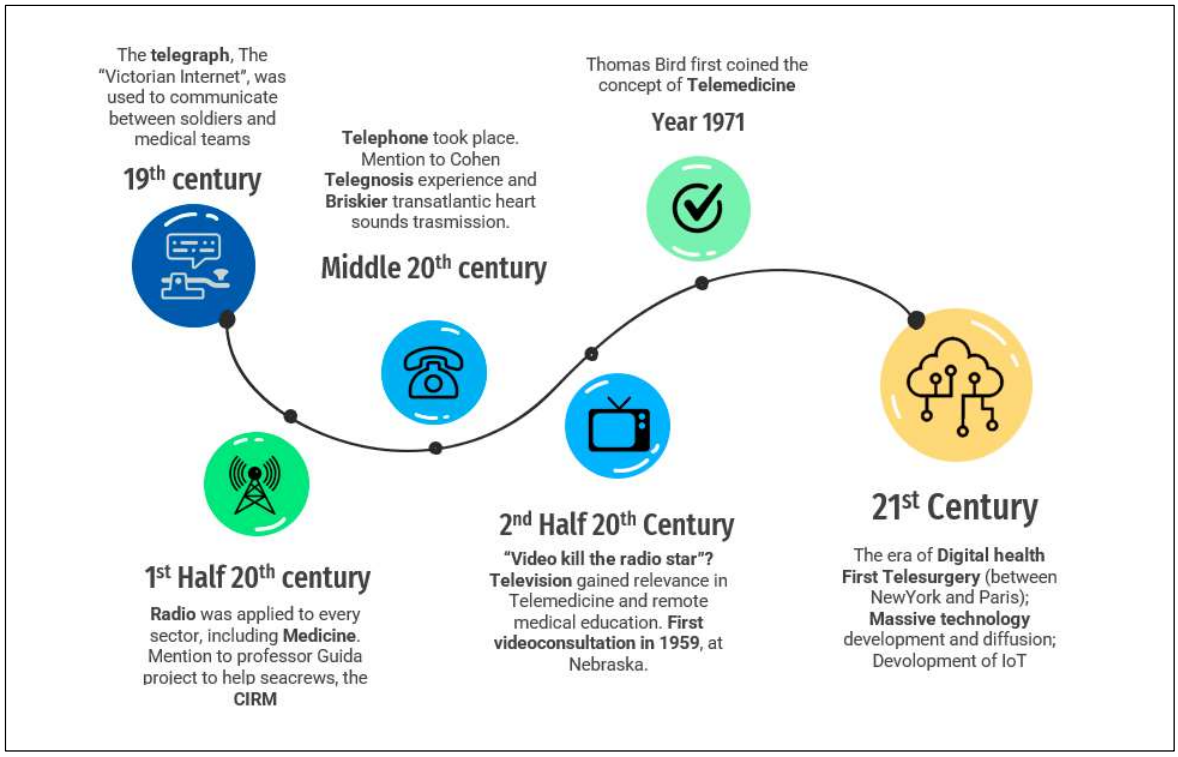

Figure 4 - Telehealth history and evolution. Source: original

1.1.3 Global approaches and applications of Telehealth

Just like the spread of any other invention, telehealth has not reached every corner of the globe equally. While certain nations are clearly at the forefront of the effective, efficient and profitable use of telehealth's benefits, others are still at the beginning of this evolution.

This is due to a number of concerns, ranging from strictly political ones (such as the political claim that Telehealth would bring more harm to the people than benefits) to economic reasons (such as the lack of financial resources and logistical capacity to adapt healthcare services structure and funding to this kind of technological solutions). Reimbursement pathways for Telehealth are developing at different paces in different markets. In general, the terms of reimbursement strictly exclude the use of digital health services or are only restricted to synchronous telehealth services. Legally speaking there is a significant legal disparity between the various nations when it comes to the regulation of remote medical practice.

This subchapter will discuss global developments in telehealth applications and national strategic and legal plans in this area. Six different territories will be taken in account: Europe, the United States, South America, Asia and Africa. We should also keep a close eye to the reality of Portugal as this study has been conducted there.

Europe

Europe has witnessed a rise in telehealth-related organizational, IT and legal solutions in the last decade. According to a 2018 European Commission market analysis on Telehealth reported that telemonitoring and prevention, together with teleconsultation, are the most common methods of intervention for telemedicine solutions in Europe. (European Commission, 2018) The same mapping also reveals a focus on basic care solutions, with diabetes, chronic obstructive pulmonary diseases and cardiovascular diseases (CVDs) being the most often addressed conditions. The bulk of the solutions examined have been in use for more than five years, which indicates a long-term commitment to investing

in this field as well as sustained demand. The same report concluded that market potential for telemedicine in Europe is predicted to expand at a compound annual growth rate of 14% and that Telemedicine solutions are in higher demand than they are supplied. (European Commission, 2018)

According to the European Observatory on Health Systems and Policies' (EOHSP) findings, the Nordic nations have the lowest access disparities to telemedicine services (Denmark, Norway, Iceland, Finland, Sweden). However, especially after the outbreak of the COVID-19 pandemics, Central and Southern Europe have increased their efforts to contribute to an extensive diffusion of Telehealth. (EOHSP, 2020)

One of the European Union's greatest successes is the creation of the single market. It helps businesses and people live more comfortably and supports economic growth and employment creation. To improve the flow of things throughout the single market, hundreds of technological, legal and administrative barriers to free commerce and free migration between European Union (EU) Member States have been abolished. As a result, businesses have grown and increased competition has reduced costs and increased customer choice. The cost of phone calls in Europe, for instance, has drastically decreased and new routes have opened up. The EU seeks to prevent these expanded freedoms from undermining sustainable development, product safety, or equality at the same time. (Aussilloux et al., 2011)

Healthcare is not an exception. The European Union may be in the greatest position to facilitate the development of cross-border telemedicine. At the European level, Telehealth is seen as both a health care and an information service and both sets of regulations are applied to this legislation as no universal regulation has been established. The 2011/24/EU directive relates to the regulation of health service delivery in Europe. Consider the directives 95/46/EU and 2000/31/EC regarding information and communication technologies. We may also don’t forget EU 2016 General Data Protection Regulation (GDPR). Although it was created and approved by the EU, it imposes requirements on any organizations that target or gather information about individuals residing in the EU. The rule became effective on May 25, 2018.

The development of the eHealth Digital Service Infrastructure (eHDSI) is one example of how technical efforts are being made. eHDSI is a platform that guarantees European individuals' access to ongoing medical treatment while they are traveling outside of the EU. This enables the secure, effective and interoperable interchange of health data among EU nations. (Palojoki et al., 2021) The services are readily identifiable by the availability of the "MyHealth @ EU" brand. In all EU nations, two electronic cross-border health services are now being implemented. First one, the ePrescription and eDispensation services enable EU citizens to get their prescription from a pharmacy in another EU nation by electronically transferring their valid prescription from their country of residence, where they are affiliated, to their country of travel. (European Commission, 2022; Swedish eHealth Agency, 2021)

There are also movements on making EU patients electronic health records accessible in every EU nation. Starting from the diffusion of patient summaries, including allergies, current medications, prior illnesses and surgeries with every member state (MS), EU policymakers have been lately encouraging interoperability solutions and ease cross-border use. In June 2022, the European Commission (EC) presented a suggestion on the European electronic health record interchange format, an effort to facilitate the free movement of health data across national boundaries, preserving the necessary data security - essential to cross border telemedicine. (European Commission, 2022) However, there is a still long run to go, as only a small number of telemedicine solutions are in use in other MS or outside the EU; the majority are still implemented at the national or regional level. (European Commission, 2018)

United States of America

United States are one of the biggest players on Telehealth. With a market worth close to $17 billion in the United States, Telehealth is a significant sector that includes everything from teleconsultation services to teleradiology. (Bestsennyy et al., 2022) A lot of for-profit healthcare originally hospital-based organizations, including Mont Sinai or Cleveland Clinic, developed their own Telehealth technologies, while other business companies and startups, such as Teladoc Health, are important players on the Telehealth world. These technologies often

rely on a smartphone app to let medical professionals and support staff keep an eye on patients who are at home. Certain technologies enable the population to obtain health information, identify nearby clinics and hospitals, undergo screening, plan new medical appointments (in-person or teleconsultations), or review their clinical history. (Bestsennyy et al., 2022; Hollander & Carr, 2020b)

There are various successful and operational telemedicine and telehealth programs in the United States, illustrating its potential. For example, the Telestroke program is a strong example of it. The term "telestroke" refers to a recent popular technique used in emergency rooms to connect with specialized neurologists, eliminating the need for in-house specialists. Stroke is a real public health problem in the United States, like in other high-income nations. During 2020, 1 in 6 fatalities from cardiovascular disease was due to stroke. In the United States, a stroke occurs every 40 seconds and causes someone's death every 3.5 minutes. However, in 2013 there were around 4 neurologists per 100,000 people across the country, required for the treatment of more than 795000 stroke victims annually. Numerous hospitals and medical organizations are using telemedicine strategies designed exclusively for stroke treatment to address the glaring deficit of neurologists. (Demaerschalk et al., 2017; Lazarus et al., 2020)

Neurologists can consult stroke patients and emergency room patients remotely from another central hospital and provide treatment recommendations quickly. It is crucial to note that Telestroke is not only a brief telephone conversation to review a patient's situation to arrange a transfer to a specialized facility. In order to shape their treatment decisions, neurologists can review patient clinical records such as brain imaging findings, blood tests, monitorizations, or other pertinent clinical data on the patient's electronic healthcare record. If necessary, specialist will advise on what therapy to begin when a patient is urgently moved to the central specialized facilities. By utilizing telestroke, hospitals allow patients to access the specialist emergency treatment they need while traveling to the nearest specialized facility, giving all patients an equal chance of survival. This concept is especially beneficial for smaller, rural hospitals that lack specialized expertise, for a wide variety of pathologies, such as other cardiovascular diseases, surgical urgencies, among others. (Sharma et al., 2020)

Furthermore, since almost all radiology tests result in digital material, telehealth has shown to be very helpful in this field. According to reports, teleradiology accounted for more than half of all telehealth services provided in the US in 2014. In 2019, 77,3% of radiologists in North America stated that teleradiology is a part of their current practice. Teleradiology, particularly in areas where there is a shortage of radiologists, fills that gap by removing the requirement for a face-to-face consultation between the patient and the radiologist and by providing patients with faster readings and conclusions. It's also important to consider that different specialized radiologists are needed for different exams. Teleradiology allows hospitals to avoid hiring a specialist radiologist for each and every area of the body, providing better resource management, cost efficiency and a more equal access to this level of care. (Rosenkrantz et al., 2019)

The progress of telehealth has occurred concurrently to legal and strategic adaptations. The U.S. Department of Health and Human Services (HHS) has been publishing and adapting the regulations on Telehealth usage, according to the developments and new emerging practices. For example, at the reimbursement level, with the rise of COVID-19 and the urgent need for telehealth services, Medicare in the US started paying for some telehealth consultations and individual states are being urged to expand Medicaid coverage for these services. Other commercial healthcare insurers copied this decision.

Also, under the COVID-19 pandemics urgency, HHS brought more information about which software is legally allowed to be used. For example, it was decided to bring more HIPAA (Health Insurance Portability and Accountability Act of 1996) flexibility, enabling the use of readily accessible communications tools by insured healthcare professionals without the threat of penalties, obviously, with some rules and restrictions. As we can consult on HHS website, providers can use regular and popular use video-chat or text-based applications, such as Apple Facetime, Zoom and Skype (for Videoconsultations) or WhatsApp, iMessage and Google Hangouts (for text), among others referred apps, for healthcare proposes without any fine. The principal rule was that the used software was a “non-public facing” application. On another hand, examples of public facing applications not allowed for Telehealth use are Facebook Live and Twitch. On top of that, they offered a list of HIPAA-compliant technologies, from which providers can know

about software with enhanced security features like Zoom for Healthcare or Microsoft Teams/Skype for Healthcare. (Bassan, 2020; Pool et al., 2021)

Apart from the HHS responsibility on Telehealth regulation, each state still has their own legal and strategic regulations on Digital health, which have also been updated recently. But, although the strong development, the stark disparities on the policy frameworks across the states are still one of the obstacles to the adoption of telemedicine. These differences call for a federal telehealth policy push to standardize and speed up a broad framework, which may increase Telehealth penetration throughout the United States. (Lee et al., 2020)

South America

Regarding telehealth, South America is still some distance behind North America. However, making this claim without placing the South America's sociodemographic characteristics and the healthcare systems in South America in their proper standpoint is incorrect.

Since the 1960s, the demographic dynamics of South America have changed. According to the Economic Commission for Latin America and the Caribbean (ECLAC), it is estimated that the fertility rate will decline by 62,8%. The projected 652-million-person population of the region in 2018 including 25% of children and teenagers under the age of 15. In Latin America nowadays, the average lifespan is 76 years. South America is paving the same path of higher incomes societies such as European or North American countries. (Camacho-Leon, Faytong-Haro, Carrera, Molero, Melean, Reyes, Mautong, De, et al., 2022)

On the other hand, up to two-thirds of the people in the area are thought to live in cities. The movement of individuals from rural areas to cities causes issues for public policy, particularly healthcare. Due to a lack of basic facilities like power and healthcare, rural communities in Latin America are at a social and economic disadvantage. (UNESCO, 2007)

Although it is challenging to assess the quality of healthcare in Latin America as a whole due to its heterogeneous healthcare systems, several

pertinent and shared characteristics may be stated. The healthcare systems in South America are generally split into public and private organizations and they show regional disparities in the availability of medical resources including facilities and staff. Given the lower wait times for medical services and generally stronger infrastructure than public institutions, private healthcare systems are thought to be of higher quality. (Ruano et al., 2021)

The COVID-19 pandemic's consequences have made it more obvious that investment in Latin America's public healthcare systems is expected to be poor, leading to even greater imbalance in care between public and private institutions. With up to 13.3 percent of its gross domestic product (GDP) invested in healthcare policies, Cuba has been identified as the nation that invests the most in its public healthcare system, whereas Venezuela invests the lowest, allocating just 1.1 percent of its GDP to the subject. Government investment in health is inversely related to healthcare out-of-pocket expenditure. For instance, in contrast to Argentina, which spends 15%, Venezuelan households may have to spend up to 63% percent of household income in healthcare. (Health at a Glance: Latin America and the Caribbean 2020, 2020)

We may thus draw the conclusion that South America Healthcare systems biggest problem is not the slightly slower Telehealth development. This brief overview of the healthcare systems in South America leads us to the conclusion that it is critical to employ cutting-edge strategies, such as information and communication technology (ICT), to satisfy the rising demand for healthcare services in both urban and rural areas of Latin American nations and the achievement of universal access and cost-efficiency in healthcare.

Latin American societies have certain benefits and some drawbacks when it comes to telehealth implementation. First, the demographics of South America can be seen as favoring the use of emerging technologies in the delivery of healthcare, since the region's high concentration of youth may indicate a stronger ability and willingness to employ these innovations. However, older or rural citizens may need training programs or technological tools facilitation. Similar to this, while the average literacy rate in the Latin American area is thought to be about 94%, facilitating the usage of new technology, Internet access is still quite restricted. Less than 50% of South American homes had fixed broadband access by 2021.

Furthermore, even in nations with better Internet connection availability, such as Brazil, it does not always mean that the connection is stable and secure. Another significant problem, for instance, is the instability of the energy infrastructure in some countries, such as Venezuela, where the system has rapidly deteriorated over time and where there have been two statewide blackouts in 2019 that left more than 20 million people without electricity. (Camacho-Leon, Faytong-Haro, Carrera, Molero, Melean, Reyes, Mautong, Hoz, et al., 2022)

The COVID-19 disruption has sped up technology advancement and implementation and advanced telehealth-related legislative improvements in Latin America. Currently, Chile, Ecuador and Uruguay are in the forefront of using these services as compared to other Latin American nations, laying the foundation for the usage of telemedicine services throughout the rest of the area. A considerable road still has to be accomplished. (Camacho-Leon, Faytong-Haro, Carrera, Molero, Melean, Reyes, Mautong, Hoz, et al., 2022)

Southeast Asia

Geographically speaking, Southeast Asia (SEA) is a diversified region in terms of sociology, politics and economy. The healthcare systems in its member nations are heterogeneously developed as a result of this variety. Nevertheless, SEA nations are committed to working together, especially to achieve universal healthcare coverage. (Nambiar et al., 2019)

Just like South America, Southeast Asia is being confronted by the socioeconomic inequities between its urban and rural populations thanks to the massive expansion it witnessed in the recent decades. Eighty percent of the 4 billion inhabitants in the region reside in rural areas, where they frequently lack basic access to medical care and education. At the moment, only around 130 million individuals in Asia can afford private healthcare, yet the majority of people in the region rely on government assistance. Most residents in the region live on US$1 per day, thus they cannot possibly afford even the most basic medical treatment. Asia also has major challenges regarding electricity and internet connections stability, particularly in rural regions. (Malay & Baisakh, 2002)

According to the World Health Organization, there aren't enough physicians in Southeast Asia, with Cambodia having the lowest doctor-to-population ratio at 1,93 and Singapore having the highest at 22,94. Furthermore, due to better opportunities and remuneration in metropolitan regions, health personnel in SEA are predominantly based there, leaving rural areas understaffed. This forces rural residents to seek treatment in cities. This issue frequently comes with long distance trips, higher costs and unreliable transportation. (Singh et al., 2021)

In order to solve the issues with the region's current healthcare systems and guarantee that everyone has access to quality healthcare, the region's governments, communities and industry partners should implement measures. In order to ensure that everyone has access to healthcare, governments, businesses and communities must come up with strategies that will allow medical care to transcend geographical, social and cultural barriers. (Macariola et al., 2021)

Similar to other global regions, most SEA nations have embraced telehealth to improve the accessibility of their healthcare systems, developing strategic plans and ensuring law regulations adaptation in order to guarantee that the data is stored securely and that patient privacy is not jeopardized.

Anticipating the growth in search for Telehealth solutions, local private stakeholders are investing in Telehealth. A few digital health startups are already on the market, such as Indonesian “Halodoc”, Singapore’s “MyDoc”, Vietnam’s Viettel, among others. In sian consumer-focused digital health industry is expected to increase from US$37.4 billion in 2020 to US$100 billion in 2025. The strongest growth engine in this area will be telehealth, followed by e-prescription and e-pharmacies services. (ASEAN Business Partners, 2021)

Africa

Telehealth programs are not new to African healthcare organizations. Several telemedicine initiatives had already been implemented in some Sub-Saharian countries, starting in the 80s. For instance, there were successful telehealth programs implemented in several African regions during the Ebola virus infection.

As program implementation grows and smartphone penetration is expected to reach 66% by 2025, Sub-Saharan Africa will be a fertile region for TH's development. However, in an even worser scale than South America, it still has one of the highest rates of sickness in the world allied to a paucity of healthcare professionals and facilities. Telehealth barriers are also significant, such as challenges with secure and stable connectivity, high expenses in the implementation of technologies, language incompatibilities (that can even occur inside the same country) or the lack of access to electricity. This emphasizes the need for creating a supporting infrastructure, for government support and engagement, for worker upskilling and for legal compliance. (Dodoo et al., 2022)

Due to persistent wars and strife, poor ICT, lack of financing and governmental support for technological dissemination and policy and other factors, telemedicine is still in its infancy in Africa.

Portugal

The first Portuguese telemedicine initiative began in 1998 at the Pediatric Cardiology service at the Centro Hospitalar e Universitario de Coimbra (CHUC), by the hand of Dr. Eduardo Castela and is since being expanding as evidenced by the rise in teleconsultations and the partnerships that are currently in place, both at the national level and with the PALOP – Portuguese-speaking African countries. Coimbra's pediatric hospital serves as the core for a telemedicine network that connects most of the hospitals in Portugal's central area. Some northern hospitals are also served by this network. At the international level, this network comprises Angola, Cape Verde, São Tomé and Principe or even Guinea. (Castela, 2017)

The "Via Verde AVC" initiative is another example of portuguese telemedicine success and it is also from CHUC. It consists in a Telestroke program developed by CHUC's Neurology department to address the cerebrovascular accident urgent treatment needs for all Portugal's central region. It was created with a basic reorganization of the resources already available in the CHUC's emergency department and serves 7 different units. Between 2015 to 2018, more than 2000 consultations were performed. (Amorim et al., 2021)

Recently, more than 85% of COVID-19 infected people in Portugal received household treatment from the start of the pandemic. These patients were mostly managed remotely by primary-care doctors using widespread mobile phone consultations for mild or asymptomatic cases, similarly to their contacts and suspected cases, which helped keep hospital (intensive) care more effective. The number of face-to-face consultations was reduced by more than 75%, and most patients could be followed up thanks to telemedicine treatments and fully paperless prescriptions. The overall drop in consultations was 6.6% less than it was the year before. (O'Neill et al., 2022)

In October 2016, years after some telemedicine initiatives began, the Portuguese Council of Ministers followed the European trend and established the Portuguese National Centre of Telehealth (CNTS) within the Shared Services of the Ministry of Health (SPMS), E.P.E, with the primary goal of fostering collaborations through a comprehensive network of partners to advance Information and Communication technologies' innovation and use and bringing the citizen closer to its health services. (CNTS, 2017) In 2019, government approved the National Strategic Plan for Telehealth (PENTS), elaborated by CNTS. (CNTS, 2022)

Similarly, to other countries, COVID19 pandemic caused teleconsultations to rise more than 700% between 2020 to 2021, in Portugal. Calls answered by SNS24, the Portuguese teletriage line, increased by 287%. This led the CNTS to adapt the PENTS to the new reality, publishing the LEDTS, a list of strategies for telehealth development, bases on 5 tendencies, 5 measures and 30 actions. For example, CNTS and SPMS are planning to build a significant amount of local equipped rooms, called "SNS Balcão", where patients without access the internet can attend or schedule a teleconsultation or get another telehealth services, in order to keep telemedicine accessible to those in risk of exclusion. (Mendes-Santos et al., 2020) Between the 30 published actions, CNTS commits to map all telehealth services ministered in Portugal, build accurate performance indicators for telemedicine and preform accurate economic evaluations, evaluate the satisfaction from patients and providers or minister telehealth education and partner with research and development entities. (SPMS, 2019)

Although still lagging behind northern European nations, Portugal's healthcare system appears to be well-suited and planed to the growth of telemedicine.

1.3 Telehealth opportunities, disadvantages and barriers

In the next subchapter it will be discussed the opportunities, disadvantages and barriers associated with Telehealth's implementation. It is important not to dissociate the mentioned disadvantages and barriers, as many of them as also present in presential consultations modes.

Opportunities

Accessibility for all citizens is one of the key arguments favoring telemedicine. Every country has a different terrain, ranging from densely populated heavily urbanized conglomerates to rural areas with limited access to high-quality healthcare. This disparity in access to medical care could be eliminated through information technology. (Barbosa et al., 2021)

Telemedicine is being used as an effective tool to raise the financial viability of healthcare systems. First off, it has the potential to lower spending by reducing prescription overuse, pointless trips to the ER, or extended hospital stays. On the other hand, offering healthcare in places where there is a dearth of medical personnel minimizes patient travel and wait times, work abstinence and provides care of a comparable standard. Better access and convenience might increase patient and professionals' satisfaction. Also, some healthcare consultations, specially related to the routine management of chronic illnesses don't even require to be presential, telemedicine offers a cheaper solution to provide the same medical treatment. In conclusion, telemedicine pledges for more efficiency and cost effectiveness in healthcare. (Rutledge et al., 2017; Snoswell et al., 2019, 2020, 2022)

Additionally, a significant new economic potential is growing with remote medical care. By the end of 2019, the size of the worldwide telemedicine market was approximately €50 billion. The impact of the COVID-19 pandemic on the world led to a sharp rise in demand for remote medical services, which helped the

industry double in size to €100 billion by the end of 2021. According to estimates, the market value of telemedicine will reach a staggering €450 billion by 2030. This is undoubtfully a great economic opportunity.

Disadvantages

There are significant drawbacks to telemedicine as well. The disconnection between the doctor and the patient is the most frequently cited drawback, especially in early 2000's literature, with the argument that a dialogue conducted over the internet cannot create a relationship between a patients and health care providers on the same level as presential consultations.(Miller, 2003) However, more recent studies have shown that patients were equally satisfied with the doctor's capacity to establish a relationship, use collaborative decision-making and encourage patient-centered interaction in telemedicine consultation when compared to in-person consultations. (Agha et al., 2009a)

On the other hand, some medical visits, such as those that need a physical examination, cannot be conducted remotely. Furthermore, the patient must always be present when doing diagnostic exams. A full body examination is not possible with the hardware and software available today, though this may change significantly in the next years. The market for wearables is growing rapidly and numerous tech firms are working to improve remote medical examination.

Nevertheless, Telemedicine is vulnerable to software flaws or disruptions in telecommunication networks. Additionally, it depends on the technology that the doctor and the patient own, and it must be regularly updated and maintained. Costs are undoubtedly involved. This draws attention to the telemedicine paradox which has been pointed out. The individual's capacity to participate in telehealth may be another social aspect, even though virtual health services claim to improve healthcare access parity whilst battling economic, social, or geographic barriers.

It's possible that the high-need patients with numerous chronic illnesses and complicated psychological need (those who stand to benefit the most from ongoing virtual care) are unintentionally being left out of this digitization boom. If this is the case, paradoxically, telemedicine may end up making people more susceptible to previously present health disparities. Even among people with

sufficient internet access, it is crucial to find out how comfortable they are with performing a telemedicine visit, because their access to the internet can be restricted to public spaces or come at a steep cost due to data fees. Due to technological inexperience or physical limitations, older persons may find it challenging to utilize telemedicine services. There's the risk for inequity. Using a template originally created by Penchansky and Thomas (1981), Sieck et al. (2021) recently suggested that improving the "Five As" of access to health care—availability, accessibility, accommodation, affordability, and accessibility - will be necessary to ensure more equitable access to telehealth and, by extension, other digital health tools. (Penchansky & Thomas, 1981; Sieck et al., 2021)

"The Five As" of access to health care	
Availability	The relationship between the patient's needs and the resources and existing telehealth services that a system provides.
Accessibility	The connection between a patient population's digital literacy and skills and the support services provided.
Accommodation	The connection between a patient's ability to use digital platforms and the platforms' demands.
Affordability	The connection between a patient's financial capacity and the price of internet services and equipment.
Acceptability	The compatibility of the patient's attitude and comfort level with the telehealth tools and workflows used by the healthcare organization.

Table 2 - "Five As" of access to health care, according to Sieck et al. Adapted from Sieck et al.

Barriers

Digital health technology implementation challenges arise at the individual, organizational and system levels and are not only technical. Although creating the appropriate technologies for eHealth systems involves technical difficulties, it has also become evident that these difficulties have not always—or even frequently—been primarily—technical in nature. It takes more than simply inserting a novel technical solution into the existing processes to adopt telemedicine and other digital health technologies. So, in fact, institutional, organizational and individual obstacles—rather than technical difficulties— are restricting the uptake of Telehealth.

Telemedicine deployment is hampered by a lack of strategy and proper policies. It is a fact that telemedicine requires cooperation with all potential stakeholders at every level of the healthcare delivery system because it is a fusion process. The lack of a proper organizational framework and policies about the provision of telemedicine services constitutes a significant bottleneck in the progression of telemedicine. Policies and regulatory concerns will be further explored in the next chapter.

Factually speaking, healthcare professionals are trained and competent to provide exceptional healthcare but are frequently under a significant amount of stress from their workload and other obligations. Being a healthcare provider means (or should mean), to collaborate with the team, follow institution rules and have a predisposition to trust people among the organization, in order to provide the patients with quality medical care. For instance, it's common practice to share passwords that are simple to guess and to provide each team member access to one desktop computer, in order to keep medical care easy and efficient, but digitally speaking dangerous. (Amorim et al., 2021)

Overall, the setting of healthcare organizations is inherently hostile to maintaining the confidentiality of health data. On the other hand, telemedicine exposes to the internet private (and almost always sensitive) clinical data that was previously only available within a closed consultation. Many anticipate that patient data can be used fraudulently or for commercial proposes. Data privacy is a serious barrier to telemedicine.

Previously, there have been a few instances where patients' private information was at risk. The WannaCry ransomware assault, which occurred in May 2017 and infected more than 200.000 systems across 150 countries, is one of the biggest recent cyberattacks against hospitals. In April 2022, the Hospital Garcia de Horta in Almada suffered an early morning cyberattack which caused a major impact on consultations and patient attendance, that lasted for more than three months.

Thus, despite the fact that it is being overlooked, cybersecurity should be a top priority as Telemedicine develops. The scope and complexity of cybersecurity is enormous, forcing enterprises to make frequent adjustments to preserve system resilience against ongoing and changing threats. As a result, risk analysis in

cybersecurity should be a continuous and iterative cycle backed by important stakeholders, directed by a group of knowledgeable information security professionals and promoted by all staff members using solid cybersecurity practices. Moreover, various types of professionals must contribute to telemedicine, such as engineers and administrative staff. This professionals should not be forgotten to legally require confidentiality, as well as traditional healthcare workers. (Weinstein et al., 2014)

Literature is unanimous about concluding that the adoption of telemedicine requires a high-quality and readily available ICT and that the adoption of telemedicine is negatively impacted by inadequate health infrastructure. However, currently used conventional electronic health record software are frequently antiquated and have a low level of integration or interoperability. The hardware must also be modified to meet the new requirements. According to a World Health Organization survey, 50% of the nations that participated reported lack of basic infrastructure, such as access to power and water which is an obvious barrier to the implementation of telemedicine. Therefore, even if telemedicine promises a future with lower prices and greater cost effectiveness, decision-makers will need significant investment to get the technology broadly started.

At the sociocultural level, the lack of physician and other healthcare professionals' acceptability about employing telemedicine methods is a continuing cultural obstacle preventing its widespread. Additionally, polling agencies' surveys showed that the doctor-patient interaction was the most important emotional aspect for medical staff. As a result, some doctors can view telemedicine as a danger to their preferred method of providing healthcare.

On the other side, patients can also be reluctant to the use of Telemedicine. In many situations, the patient's unwillingness to accept or even demand the usage of telemedicine solutions is due to ignorance of or lack of confidence in technological advancements in general. This is highly connected to the low rate of digital literacy in some countries' populations. Elderly, poor income and lack of a college education are associated with higher rates of digital illiteracy. For example, Eurostat (2017) reported that only 27% of EU citizens aged 65–74 used the internet to interact with public authorities, while in Portugal this percentage was

even worse (14%). Other patients may ultimately prefer in-person medical appointments. (European Commission, 2018)

1.4 Legal and Ethical considerations

Confidentiality, security, informed consent, accountability, jurisprudence, fair competition, remuneration for services and technology standards are among the ethical issues that are relevant in telehealth. It remains a medical act and is therefore it should be supported by the fundamental general principles that surround medical practice: the principle of autonomy, beneficence, non-maleficence and justice. However, Telehealth introduces some variations related to these principles.

The 1999 Tel Aviv Declaration had already raised concerns about the risks brought about using communication channels between a doctor and a patient, specifically with regard to the confidentiality and security of the shared information. According to this declaration, the foundation of this interaction should be respect for one another, the doctor's independence of judgment, the patient's autonomy and professional confidentiality. (Gajarawala & Pelkowski, 2021; Weinstein et al., 2014)

Nevertheless, even though this situation was anticipated and well documented, there has been a relative delay in the implementation of ethical and legal recommendations aimed towards telehealth practice, with very few countries as exceptions. Most nations have minimal laws regarding telemedicine and some may even have outdated, insufficient, or ambiguous regulations and procedures. Few governments have established national legislation or professional and ethical norms for the delivery of telemedicine services. Furthermore, beside regulation development, there should also be the concern to make the same regulation effective as a tool to protect both teleconsultation stakeholders (doctor and patient).

For the Portuguese setting, various legal and ethical regulations have been established throughout the years with the aim of regulating and operating Telehealth practices. It is important to draw attention to Portuguese Normative Order nº. 3570/2013 by the General Directorate of Health (DGS), which permits

the use of Telemedicine as a cutting-edge tool that facilitates a policy of proximity between healthcare providers and the patients they treat, as well as the development of various clinical orientation standards for telehealth. According to the Deontological Code from the Portuguese Medical Association, the exercise of telemedicine is reported in 46th and subsequent articles as an acceptable medical act, where factors such as respect for the doctor-patient relationship, the physician's responsibility in the telemedicine procedure and the fulfillment and assurance of the quality and safety of their practice are outlined. However, although the portuguese setting is relatively rich in terms of legal and normative documents, a lot more telehealth related issues, such as reimbursement or liability are still not specific addressed in any regulation. It deserves further improvement.

On a different level, telehealth, as previously said, allows the delivery of medical treatment anywhere in the globe by eliminating the dependence on boundaries. Cross-border TH is also a source of ethical disagreements and legal issues related to telehealth. There is little uniformity of legislation among EU member states or even among the United States of America. The world is not even closely legally prepared to this upcoming reality. Legal issues about civil liability, compliance with data protection regulations, cross-border telemedicine licensing, or even the conditions and rights for reimbursements are being yield.(Bestsennyy et al., 2022)

In juxtaposition, new telemedicine private enterprises are emerging as a result of expanding public demand, which has been boosted by the COVID19 pandemic. (Nagappan et al., 2022) Should this new telemedicine stakeholders (such as eHealth platforms that are connecting doctors to patients), take any kind of responsibility from any error or malpractice? In many of the nations, this question is still unaddressed.

1.5 Telehealth Satisfaction measurement instruments

Beginning throughout the 17th century, aspiring researchers were taught the scientific method, which consists of methodical observation, measurement and experimentation as well as the creation, testing and adjustment of hypotheses. This facilitates communication between researchers and study groups and helps in standardizing methodologies.

Standardized approaches to the development, use and interpretation of measures and measurement tools are relevant in research. The validity and reliability of the measurement tools are important determinants on investigation results, interpretation and extrapolation. The process of creating and validating an instrument is largely concerned with minimizing measurement error. The degree to which a test actually measures what it claims to measure is known as Validity. A test must be valid in order for the results to be applied and interpreted correctly. A corpus of research demonstrating the connection between the test and the behavior it is meant to assess, rather than a single number, determines validity. Measurement instrument internal consistency, measure stability and interrater reliability of instrument scores are all evaluated by Reliability estimates. (Kimberlin & Winterstein, 2008) Choosing the right measurement instrument is also important since it will enable the study's reproducibility. (Plesser, 2018)

Regarding this investigation's main theme, evaluating Telehealth physicians' satisfaction should be done by using a previous validated measurement too questionnaire with internal consistency and also great reliability. It was performed a scoping review of literature to identify questionnaires dedicated to Telehealth provider's satisfaction. In the next two subchapters it will be described the methodology and this investigation results.

1.5.1 Scoping Review Methodology

The development of the questionnaire started with a systematic review of the existing telemedicine satisfaction questionnaires. First step was preforming a systematic search of publications related to the subject under discussion using the

following MeSH terms, in English: "Telemedicine," "Videoconferencing," "Health Personnel," "Personal Satisfaction," "Patient Satisfaction," and "Surveys and Questionnaires". It has also been used the following keywords: "Telehealth," "Telecare," "Healthcare providers," "Healthcare workers," "Providers," "Healthcare professionals," "satisfaction," "usability," "feasibility," "satisfaction evaluation," "satisfaction measurement," "questionnaire," and "survey"). Several databases were used including PubMed®, Science Direct® and the digital libraries of the Universities of Coimbra, Porto and Lisbon. All articles published up to the date of December 1, 2021, regardless of their country of origin, were accepted.

Information was gathered between December 1 and December 10, 2021. Every original article, case study, systematic review and meta-analyses were included. No specialist recommendations, narrative reviews, commentaries, or book chapters were discovered with the systematic research methodology that was employed. Duplicate results were excluded.

After that, the articles were filtered by title and abstract. After this preliminary screening, thoroughly review all the articles of interest to identify whether articles made use of valid questionnaires focusing on the usability and viability of telemedicine technologies. Articles using unvalidated questionnaires were excluded. The articles were also rejected since it was unable to access them in their entirety.

Several data from the articles were extracted while they were being read, including the study's country, model, year of publication and target population. We also registered the medical specialty on focus, the type of telehealth technology being evaluated and whether the study was motivated by the Covid-19 pandemic. Finally, a detailed statistical analysis of the previously listed variables and an analysis of the selected questionnaires were conducted, including consideration of the question's creation year, the areas it evaluated, the audience it was intended for and the languages in which it is currently translated.

PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses – guidelines were used as a guide throughout the writing of the current review.

According to the qualities of the questionnaire and its suitability for this study's proposal, we selected the most pertinent one. After obtaining the authors' consent, it was then translated into European Portuguese and added to the survey.

1.5.2 Scoping Review Results

As it was the logical sequence in which this research project was developed, this dissertation will begin by summarizing the findings of the systematic review.

There were identified a total of 695 possibly relevant articles. We excluded duplicate (n=32) and inaccessible articles. (n=11). Title and abstract revision led to the exclusion of 367 articles that did not meet the criteria for inclusion since they did not discuss or evaluate the usability, validity, or satisfaction of the telehealth technologies. Twenty-six probably relevant articles from grey literature were integrated into the remaining 285 articles. These 311 articles underwent thorough revision, yielding a final sample of 96 publications of interest that included at least one relevant and previously validated questionnaire. The remaining articles relied on originally built questionnaires without validity studies or missed the pursued thematic (N=215). This process is resumed in figure 5.

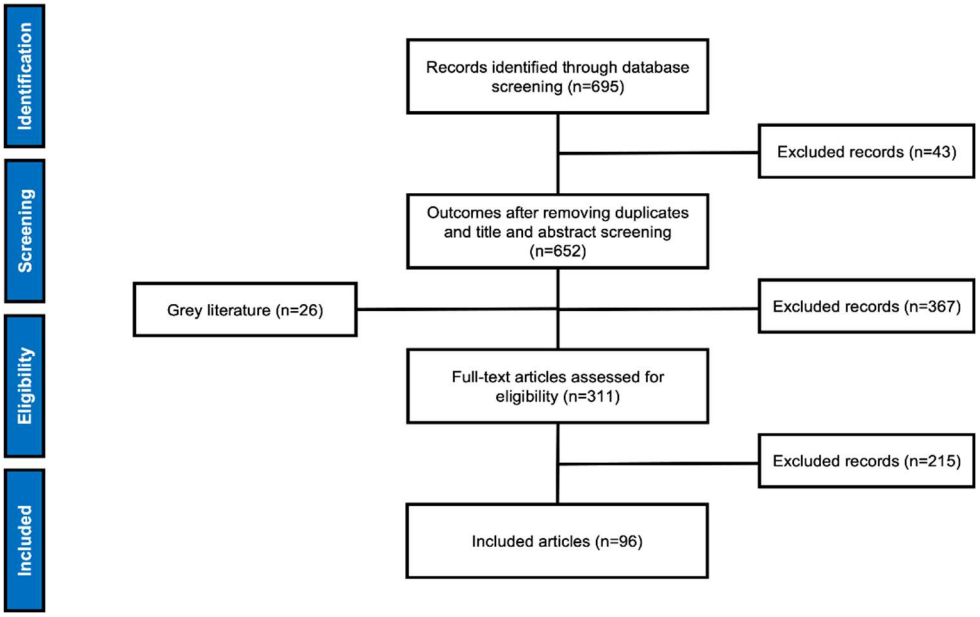

Figure 5 - Article selection process

It is important to note that 73 of the 96 articles (76%) were written during the last two years and that 32% (N=31) were expressly motivated by the growing need to evaluate the success of the implementation of telehealth services during COVID-19. This proportions illustrate the recent boom in telemedicine literature.

Fourteen questionnaires were identified with the purpose of assessing the satisfaction, viability and validity of the implementation of telemedicine in the delivery of healthcare services. System usability scale (SUS) (N=41), Telehealth usability questionnaire (TUQ) (N=24), Telehealth Satisfaction Questionnaire (TSQ) (N=10), Telemedicine Satisfaction and Usefulness Questionnaire (TSUQ) (N=5), among many others, were listed in order of frequency. The list of every detected questionnaire can be found in the table 3.

The System Usability Scale (SUS) was developed by Brooke et al. in 1986 with the aim of evaluating the usability of electronic systems regardless of their intended use, that is, it was not specifically designed for the setting of telemedicine. This tool has 10 items on a Likert scale without any designated categories. (Brooke, 1986)

In 1986, Parmanto et al. published the Telehealth usability questionnaire (TUQ), which was created to evaluate the usability and satisfaction of using telemedicine services. It is made up of 21 components that are divided into 6 categories: utility (3 questions), usability and learning (3 questions), interface quality (4 questions), interaction quality (4 questions), reliability (3 questions) and satisfaction and future use (4 questions). According to Parmanto et al., the construction of the questionnaire was based on combining elements from other questionnaires such as the Post-Study System Usability Questionnaire (PSSUQ), the Telehealth Satisfaction Questionnaire (TSQ) and the Technology Acceptance Model (TAM). (Parmanto et al., 2016)

Yip and colleagues developed the Telehealth Satisfaction Questionnaire (TSQ) in 2003 with the primary goal of measuring user satisfaction while using telemedicine services. It consists of 14 Likert scale items that are uncategorized. (Yip et al., 2003)

The TSUQ, published by Bakken et al., focuses on the evaluation of the utility and satisfaction of telemedicine systems. The tool has 26 questions divided into two categories (satisfaction - 21 items, utility - 5 items). (Bakken et al., 2006)

Questionnaire	Year	Authors	Questionnaire evaluated dimensions	Target	n
SUS	1986	Brooke *et al.*	Easy use and learning, satisfaction and future use.	Patient and Professional	41
TUQ	2016	Parmanto *et al.*	Utility, Usability and ease of learning, Interface's quality, reliability, satisfaction and future use.	Patient and Professional	24
TSQ	2003	Yip *et al.*	Utility, Usability and ease of learning, Reliability, satisfaction and Interface's quality	Patient	10
TSUQ	2006	Bakken *et al.*	Utility, Ease of use and learning, Reliability, Satisfaction and Efficiency	Patient	5
CSQ	1982	Attkisson *et al.*	Satisfaction, Interface quality and potential Future use	Patient and Professional	3
PSQ	1983	Ware *et al.*	Utility, Ease of use and Reliability	Patient	3
SUTAQ	2017	Hirani *et al.*	Efficiency, Satisfaction and Privacy	Patient and Professional	2
USEQ	2017	Gil-Gómez *et al.*	Utility, Ease of Use and learning, Satisfaction, Efficiency	Patient	2
TAM	1989	Davis FD	Utility, Usability and Ease of learning, Acceptance toward technology	Patient and Professional	1
PSSUQ	1988	IBM	System performance, Interface quality, Satisfaction	Patient	1
QUIS	1988	Chin et al	Usability, Ease of Use and Learning	Patient	1
PACT	2009	Agha *et al.*	Communication, Impact on patient-doctor communication	Patient and Professional	1
e-HIQ	2013	Kelly *et al.*	Utility,Usability, Interface Quality, Reliability	Patient	1
MAUQ	2019	Zhou *et al.*	Utility, Usability and ease of learning, Interface quality, Consistency, Reliability, Satisfaction and future use.	Patient and Professional	1

Table 3 - Identified telehealth satisfaction measurement instruments. SUS - System Usability Scale; TUQ - Telehealth Usability Questionnaire; TSQ - Telemedicine Satisfaction Questionnaire; TSUQ - Telemedicine Satisfaction and Usefulness Questionnaire; CSQ - Client Satisfaction Questionnaire; PSQ - Patient Satisfaction Questionnaire; SUTAQ - Service User Technology Acceptability Questionnaire; USEQ - User Satisfaction Evaluation Questionnaire; TAM - Technology Acceptance Model; PSSUQ - Post-Study System Usability Questionnaire; QUIS - Questionnaire for User Interface Satisfaction; PACT - Patient Assessment of Communication during Telemedicine; e-HIQ - E-Health Impact Questionnaire; MAUQ - mHealth app usability questionnaire; n – number

The Client Satisfaction Questionnaire (CSQ) was introduced by Attkisson *et al.* in 1982 with the goal of standardizing the methods for gauging customer satisfaction across various service sectors. Although the original format included 18 items, there are smaller versions with 3 and 8 items that have been translated into more than 30 other languages. It is not a telemedicine specific questionnaire. (Attkisson & Zwick, 1982)

The Patient Satisfaction Questionnaire (PSQ) was developed by Ware *et al.* in 1983 with the goal of assessing patients' satisfaction with the delivery of healthcare services, not just telehealth services specifically. The original version had 80 questions divided into 7 categories, including satisfaction, technical quality, communication, interpersonal style, financial questions, consultation time, availability, and convenience. There is a condensed version with only 18 questions. (Thayaparan & Mahdi, 2013; Ware et al., 1983)

Furthermore, Hirani *et al*. published the Service User Technology Acceptability Questionnaire (SUTAQ) in 2017. It consists of 22 items that are divided into six groups according to their classifications: positive effects and accessibility (9 items), patient privacy or discomfort (4 items), technical concerns (3 items), substitutability (3 items), and satisfaction (3 items). (Hirani et al., 2017)

The main goal of the User Satisfaction Evaluation Questionnaire (USEQ), published in 2017 by Gil-Gómez et al., is to assess user satisfaction. It is composed of 6 questions that use the Likert scale and range from 1 to 5. It should be noted that the current questionnaire has already described a translation and validation in European Portuguese. (Gil-Gómez et al., 2017)

Technology Acceptance Model (TAM), created by Davis in 1989, is a model for evaluating a user's acceptance towards technological platforms. From this model, a questionnaire with 12 items was developed that was focused on the user's perception of the utility and ease of use. (Davis, 1989)

In 1988, the International Business Machines Corporation (IBM) developed the Post-Study System Usability Questionnaire (PSSUQ) to measure user satisfaction following a usability study. The current questionnaire had three versions, the last of which had 16 questions with a Likert scale and seven points to

assess the information's usefulness, accuracy, and system interface quality. (Sauro & Lewis, 2016)

The Patient Assessment of Communication during Telemedicine (PACT) is a tool focused on measuring patient and healthcare professional satisfaction with regard to communication quality (16 questions), clinical competency (9 questions), interpersonal competency (6 questions), and comfort (2 questions). Therefore, it has 33 questions overall and was published in 2009 by Agha and colleagues. (Agha et al., 2009b)

In 1988, Chin *et al.* developed a test instrument for usability, satisfaction, and quality of computer-human interfaces, the Questionnaire for User Interface Satisfaction (QUIS). It consists of 27 items divided into 5 sections and is not exclusive for telemedicine. (Chin et al., 1988)

Finally, there were two more recent studies that were specifically related to mobile health information applications and websites, the mHealth App Usability Questionnaire (MAUQ) and the E-Health Impact Questionnaire (e-HIQ), respectively. The 18 items that make up the MAUQ are divided into three categories: usability, interface quality and satisfaction, and utility. Finally, the 2013 e-HIQ, created and published by Kelly and colleagues, is split into two halves with 11 and 26 items each. The main goal is to evaluate the user's perception of the usefulness, satisfaction, and motivation of the online health information distribution. The first section is focused on websites in general, while the second section is adaptable to the online platform that will be evaluated. (Zhou, Bao, Setiawan, et al., 2019)

Out of every detected previously validated questionnaires, according to the qualities of the questionnaire and its suitability for this study's proposal, TUQ – Telehealth Usability Questionnaire, was the chosen to be translated into European Portuguese and used in our survey, after the authors agreement.

2. Methods

The most important and fundamental aspect of a study is formulating a suitable research question. This aids in generating a hypothesis, formulating goals and objectives and carrying out the study's methodology. Research topics are typically created by funneling a detailed, literature-based study of the gaps in earlier studies to a narrowly focused issue. The PICO structure should be used to outline the research topic and it should also meet the FINER (feasible, fascinating, new, ethically sound, and relevant) criteria for practical considerations. (Aslam & Emmanuel, 2010)

The current chapter presents the paradigm, the research hypotheses and methodology of the study, as well as the methodological choices made in the many stages of the investigation, including exploratory, qualitative and quantitative research.

2.1 Objectives

It is known that Digital Health, including Telehealth solutions cannot only consist in a digitalization of the way that healthcare is already provided. The issue lies in adjusting the new tools to the population's and healthcare professionals' needs while maintaining a constant focus on healthcare's ongoing improvement and patient security.

This dissertation's research goals are summarized in the following topics:

- Provide a detailed analysis of Portuguese current Telehealth situation in order to aid in the planning, advancement and regulation of this technologies. We aim to describe how doctors often use telehealth, as well as their opinions, levels of expertise and satisfaction regarding telehealth.
- Assess the medical providers satisfaction about the current instituted Telehealth technologies in Portugal.

Following objective description, it is needed to clarify to the reader this studies hypotheses.

Hypothesis are explanations or interpretations of predetermined phenomena that point in the direction of what they are intended to demonstrate. They are proposed as preliminary lines of inquiry and serve as an effective facilitator for research, giving the researcher criteria for choosing the most relevant data for the study. In order not to jeopardize one of the most essential investigation steps, investigation hypothesis will be described in table 4.

	Hypotheses
H1	"Telehealth is a part of the majority of portuguese physicians' routine."
H2	"There are factors that influences portuguese physicians' probability to use telehealth in their daily practice."
H3	"Doctors prefer different means of communication to reach patients during tele consultations."
H4	"Regarding videoconsultation, portuguese physicians tend to use more frequently other platforms than others."
H5	"Portuguese physicians tend to perform teleconsultations in some spaces more frequently than others."
H6	"Portuguese physicians consider that teleconsultations should be frequently preformed using video support."
H7	"Portuguese physicians write on patients' eHR after every teleconsultation."
H8	"There are important clinical and technical barriers that hinder telehealth usage."
H9	"Teleconsultations takes less time than in-face consultations"
H10	"Specialties' boards define the concept, rules and strategies for the telehealth practice"
H11	"There are important factors that physicians think should be improved in order to potentiate telehealth implementation"
H12	"Portuguese physicians' satisfaction and future use regarding Telehealth is influenced by some factors, such as gender, region, system of practice, type of institution or type of specialty."

Table 4 - Dissertation hypothesis

The next step in the research will involve testing the hypotheses by comparing them to the data from the observation.

2.2 Data Collection

This study is design to be an observational, cross-sectional and analytical study conducted in order to characterize Telehealth national landscape as well as to inquire doctors on their actual opinion about the current Portuguese Telehealth state-of-art. The study was based on a questionnaire with 25 questions that was formatted online using Limesurvey platform.

Due to the fact that doctors are the only people targeted by this study, we used distribution and promotion methods for the questionnaire that were aimed directly towards doctors. The Portuguese Medical Association's support allowed the questionnaire to be distributed to every email address registered on the association's mailing list. Other contributors also had a significant impact on the dissemination, such as the medical information app TonicApp, which used its mailing list to recruit more participants for this study. All communications were conducted over closed channel intended only for medical professionals, preventing participation from other professions. Participants had to enter a password that could only be accessed through the aforementioned distribution channels in order to participate in the survey.

Survey Creation

In order to achieve the study's second objective, a few pertinent questions were included to characterize the present situation of Portuguese telemedicine practice as well as physicians' attitudes toward it in the post-COVID era. The survey also made it possible to gather demographic data from participants, such as gender, age, the region of health care where they work, their place of employment (for example, hospital, primary health care services - family health unit, individualized health care unit -, private unit), level of medical specialization and specialty.

Additionally, information about the experience with teleconsultations was gathered, including how often professionals used it beforehand, how many teleconsultations they had performed, whether they were initial or follow-up visits, the infrastructure and technologies being used, any technical or clinical challenges

encountered and their motivation for using telemedicine in the future. Furthermore, questions regarding perceptions of Telemedicine, such as satisfaction, the quality of the care given and the use of video support, were included. The responses to these questions were evaluated using a Likert scale with a maximum of five points.

The survey was developed based on the discussion in a dedicated working group based on literature review. Some questions were also adapted from a previous study questionnaire so that we can evaluate if there was some significant progression overtime.

The final version of survey can be consulted in the appendix section.

Exclusion Criteria

The only exclusion criteria from this study are the absence of informed consent or the absence of answer to any question a apart from the consent ones. Following accurate interpretation and whenever possible, every partial response to the query will be recorded.

2.3 Data Analyses

A descriptive analysis of the sample characteristics and other pertinent variables, such as telehealth usage frequency, portuguese physicians' opinions and perceptions, among others, was done. According to appropriateness, several categorical variables were presented as frequencies, proportions, or percentages.

After that, a multivariate factor analysis was performed regarding the 10^{th} and 17^{th} questions, which are basically questionnaires with Likert scales as answers. It was obtained a list of statistically significant different components which grouped the questions and were then interpreted and named after the characteristics these questions evaluated. Differences on the answers between groups were analyzed using independent samples t-student tests or ANOVA variance analysis. If it was identified any statistically significant difference, post-hoc Scheffe's test was performed.

The statistical analyses were performed using SPSS 28 and the 95% confidence intervals (CI) and p-value below 0,05 were regarded as statistically significant.

2.3 Ethical Considerations

The present investigation was evaluated and approved by ARS Centro. Prior to the introduction of the survey, all participants' written informed consent was obtained.

There are no conflicts of interest involving the current work. No public or private sector organization provided any financial support for this project.

3. Results

This chapter's primary goal is to describe the key findings of the study resulting from the statistical analysis of the data gathered from the surveys distribution. First, a characterization of the sample's profile using descriptive statistics is carried out. Second, a useful descriptive analysis on the most relevant variables, with or without group stratification, was performed, according to the study objectives and proposed hypothesis. A third portion of this chapter describes the results of the performed inferential analysis on physicians' reported satisfaction and future use.

3.1 Sample characterization and descriptive analysis

Between August 12 and September 12 of 2022, 1016 valid responses to the questionnaire survey were collected, which represents more than 1,7% of all physicians in Portugal. Since we counted incomplete saved responses as valid responses, there may be some fluctuation in the total number of participants. Additionally, several questions allow for the selection of more than one response. Six participants didn't answer any questions, 1010 is higher total number of acceptable responses.

The participant characteristics can be found listed in table 5. Our sample was constituted by 58% female (n = 409) and 41,4% male (n = 292). Four participants preferred not to reveal their gender. The subgroup of doctors under or equal to 35 years old was the most represented in this study (27,4%, n=192) and the group aged between 46 and 55 years old had fewer responses (13,9%, n=97). Regarding the participants' geographical distribution, the most represented health administration region was "ARS Lisboa e Vale do Tejo", followed by "ARS Norte" (42,7%, n=301 and 33,9%, n=239).

Specialist doctors accounted for 62,2% of the participants (n=434), 15% resident doctors (n=105) and 20,5% (n=143) of the participants were head/coordinators of medical services/institutions. More than 2% of the doctors declared that they didn't have any specialty (n=16). Family Medicine was the

medical specialty with the greatest representation, followed by Internal Medicine, Pediatrics and Psychiatry. Almost seventy-eight percent of the participants represented strictly medical specialties (n=540) and 18,2% surgical specialties (n=126). Ten responses were from diagnostic auxiliary specialties, such as radiology. Additionally, 38,2% of the participants mentioned they practiced medicine exclusively on the national health service, 28,5% exclusively in private and 33,3% both in the public and private systems.

Variables	n (%)
Gender	
Male	292 (41,4%)
Female	409 (58%)
Rather not say	4 (0,6%)
Age	
<36 years	192 (27,4%)
36-45 years	170 (24,3%)
46-55 years	97 (13,8%)
56-65 years	131 (18,7%)
>65 years	111 (15,8%)
Health Administrations Region	
ARS Norte	239 (33,9%)
ARS Centro	105 (14,9%)
ARS Lisboa e Vale do Tejo	301 (42,7%)
ARS Alentejo	13 (1,8%)
ARS Algarve	17 (2,4%)
SRS Açores	14 (2%)
SSRA Madeira	16 (2,3%)
Grade of differentiation	
Head of the Service/Coordinator	143 (20,5%)
Specialist doctors	434 (62,2%)
Resident Doctors	105 (15%)
Without specialty	16 (2,3%)
Type of institutions	
Hospital	351 (%)
Central Hospital	192 (29,4%)
Peripheric Hospital	159 (24,4%)
Primary Care	172 (26,4%)
Private institutions/Independent practice	124 (18,6%)
Others	6 (1,2%)
Type of specialty (without specialty excluded)	
Medical	540 (77,9%)
Surgical	126 (18,2%)
Diagnostic	10 (1,4%)

Table 5 - Professional characterization of the participants. "<" – less than; ">" – more than

The majority of the participating doctors – 55,1% (n = 552) - said that telehealth is a part of their regular practice. The rates of telehealth practice are comparable and around 55% if participants are divided by their medical practice systems (exclusively public, exclusively private, or both), being physicians practicing both in public and private systems the ones rating the highest proportion (62,4%, n = 209).

Variables	n (%)
Is Telehealth a part of your daily practice?	
Yes	552 (55,1%)
No	450 (44,9%)

Table 6 - Telehealth daily practice rates

Furthermore, 71,8% claimed to have performed at least one teleconsultation in the preceding six months, while 28,2% of participants reported they didn't do any teleconsultations in the same period. The proportion breakdown for number of teleconsultations conducted in the last 6 months is shown in table.

Still related to the outcome "Number of teleconsultations conducted in the last 6 months", it's important to acknowledge distinctions between groups according to some variables, such as sex, age, type of specialization, type of healthcare institution, degree of differentiation and system of practice. The figure 6 also illustrates the relationship between the number of teleconsultations and the mentioned variables. The complete data can be consulted in the appendix section.

For instance, 88,3% (n=361) of female doctors have reported being using teleconsultations, as opposed to 77,4% (n=226) of male doctors. Only 9,4% (n=16) of the doctors aged between 36 and 45 reported having no recent teleconsultations, being the best performing group. Surprisingly, 69,4% (n=77) of doctors over 65 years old reported using teleconsultations. Medical specialties doctors performed teleconsultations more frequently than surgical specialties (87,8%, n=474 against 73,8%, n=93). More than 95% of public primary care practitioners had taken part in at least one teleconsultation (95,4%, n=164) surpassing central (81,2%, n= 156) and peripheral (79,9%, n=127) hospitals' physicians. Regarding the degree of differentiation, specialist doctors (85,8%, n=375) outperformed resident doctors (81,9%, n=86) and service

directors/coordinators (79%, n= 113) and undifferentiated doctors (84,6%, n=13). Comparing public with private practice, participants practicing in both private and public systems (77,5%, n=258) outperformed doctors exclusively practicing in public (73,9%, n= 281) and private (61,8%, n=168).

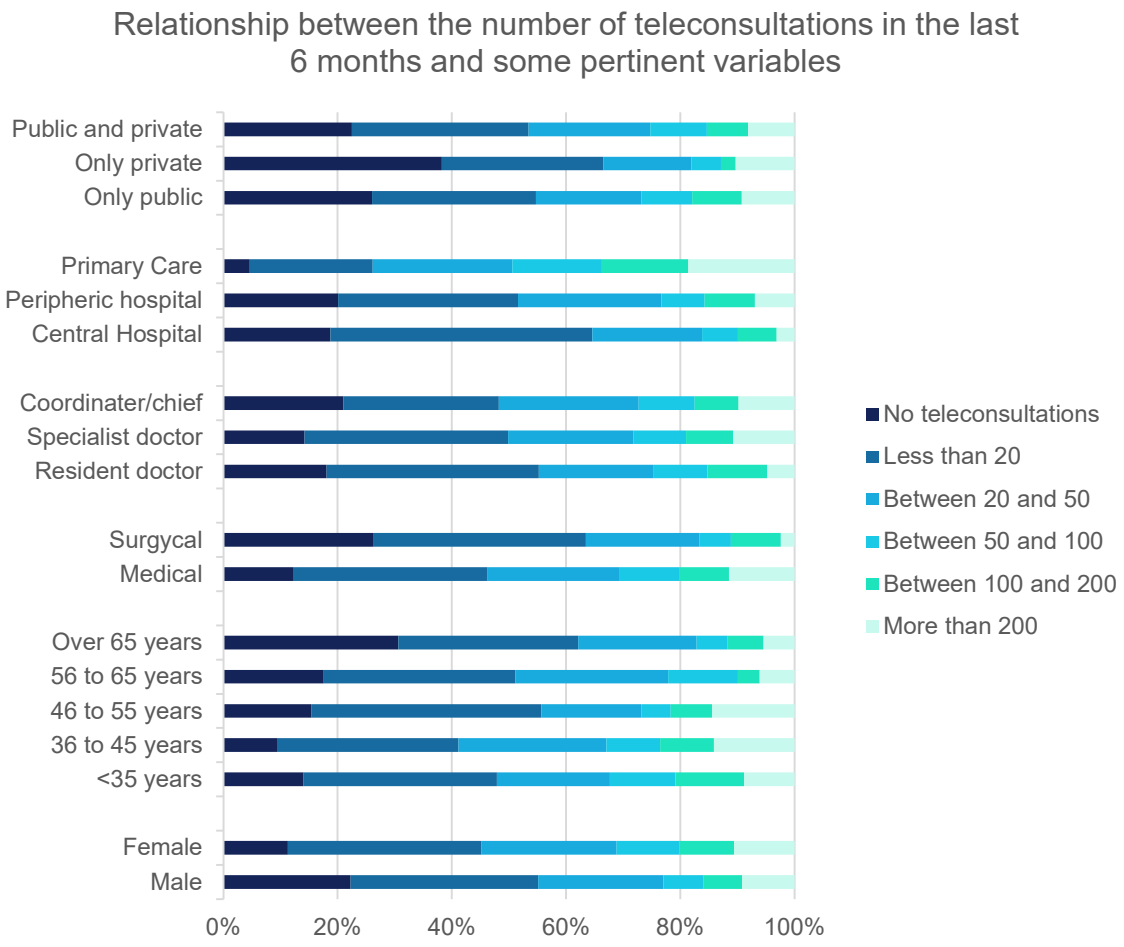

Figure 6 - Relationship between the number of teleconsultations in the last 6 months and some pertinent variables - Bar chart

In the figure 7, we have represented the most common reported types of remote doctor-patient communication vias. Phone calls lead the responses (74,5%, n=674), followed by sending (52,9%, n=479) and receiving documents via email (46,2%, n=418). Almost one fifth of the participants performed videoconsultations (n=222). The utilization of a Telehealth dedicated platform is still as low as around 6,9% to send and 8,6% to receive documentation or clinical data. A few doctors have highlighted telemonitoring platforms as their mean of communication (n=3). It is also interesting to highlight that a not-small percentage of participants still use mail to communicate with patients (16,9% to send and 8,2% to receive clinical documentation).

Additionally, the ones that reported doing videoconsultations were invited to specify the platform/software they used in those consultations. Participants were allowed to choose/write more than one platform. In figure 8, we represent the frequency distribution on the responses. The most used software is Zoom (n=72), closely followed by WhatsApp (n=70) and Microsoft Teams (n=51). Skype is still a relevant platform (n=29). Relevant mention to Panacea by Knokcare, a Portuguese startup software dedicated to phone call, video and home consultations. RSE live, the public platform developed by SPMS, accounts with only 9 responses which is relatively low in a Universe of 222 responses.

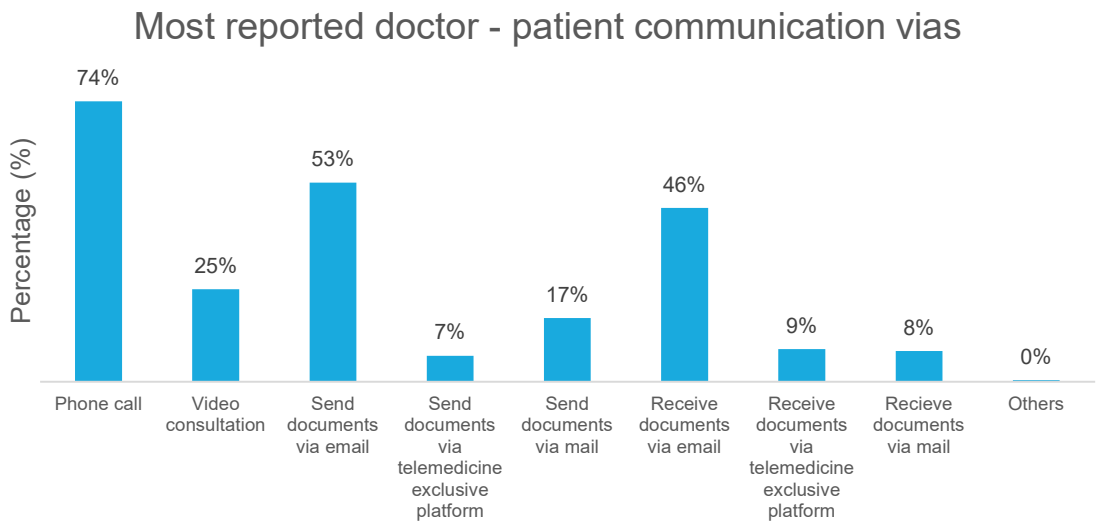

Figure 7 - Proportion breakdown on the most reported doctor-patient remote communication vias

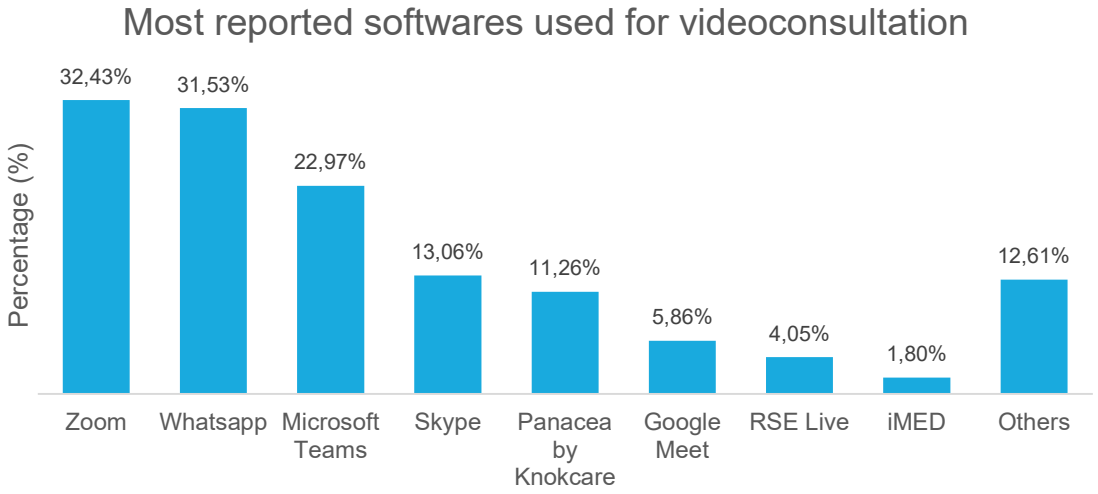

Figure 8 - Most frequently reported videoconsultation software technologies. Between the "others" group are Portuguese private hospital exclusive platforms, such as Hospital da Luz or CUF, Medigraf, MedicineOne or even TonicApp, among other answers, that count less than 4 answers

Regular individual room was the most commonly place used to perform teleconsultations, both in the context of public and private practice (67,7%, n=451 and 35,2%, n=184). Only 3,3% and 4,6% of doctors had a dedicated room for telehealth and more than 20% answered that they had conducted teleconsultations in a shared room in their public practice. It's important to note that the participants had the opportunity to select more than one response.

Variables	n (%)
Public practice	**666 (73,3%)**
Telemedicine exclusive room	22 (3,3%)
Regular individual room	451 (67,7%)
Shared room	135 (20,3%)
Outside medical institution	91 (13,7%)
Private practice	**523 (57,6%)**
Telemedicine exclusive room	24 (4,6%)
Regular individual room	184 (35,2%)
Shared room	22 (4,2%)
Outside medical institution	147 (28,1%)

Table 7 - Frequency and percentage breakdown concerning telehealth spaces

Physicians' attitudes and perceptions towards Telehealth in Portugal

Initially, an assessment of participant opinions was done about the need for video support during remote consultations and on the necessity of recording information in the patient's electronic health records (eHR). These rates were compared for professionals working in the public and private sectors as well as those who only work both in the public sector.

In figures 9 and 10, it can be consulted the distribution in participants answers. Regarding video support importance in teleconsultations, there is a clear asymmetry between the professionals working only in private versus the other groups. Almost half of private medical practitioners consider that video support is always important, while the other groups adopt a neutral opinion regarding this

subject. Concerning data registration in patients' eHR, there is a similar distribution between groups, but private medical practitioners reported to be registering slightly less than the others.

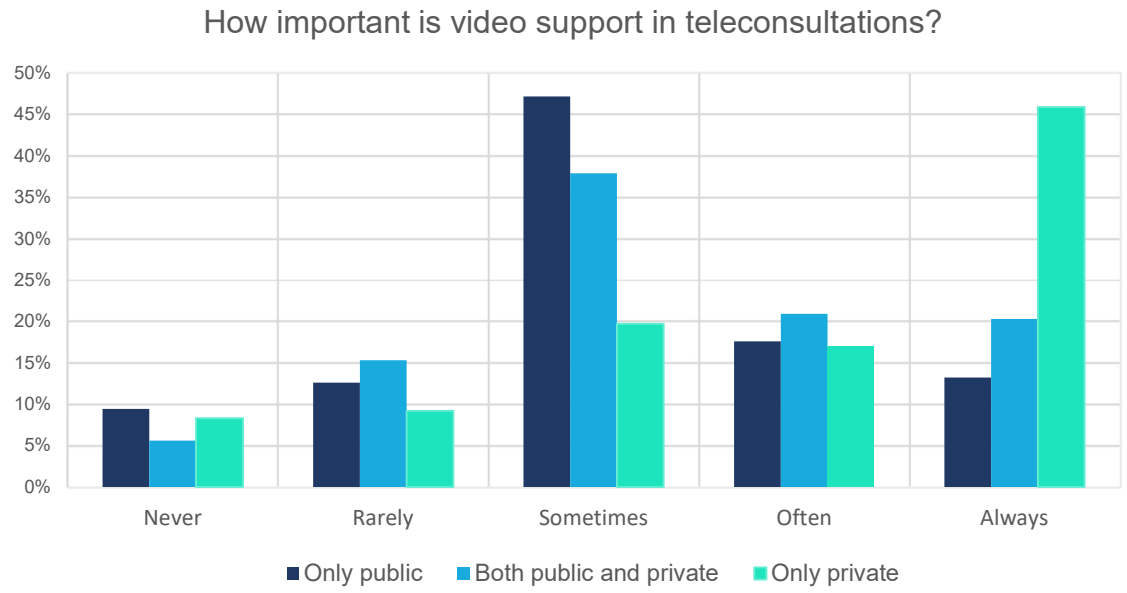

Figure 9 - Opinion distribution about the importance of video support on remote medical consultations

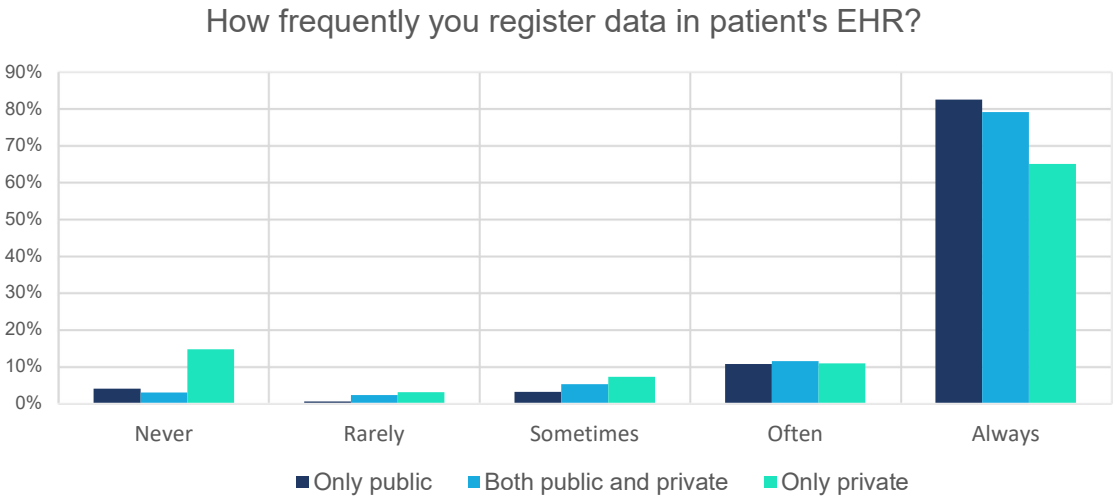

Figure 10 - Frequency distribution regarding clinical data registration on patients' electronic health records

When asked about the reasons why doctors didn't always register on patients' EHR, the most common answers were inadaptation of clinical software and lack of time to do so. Only 12 doctors stated they did not submit clinical registrations because they were unaware of the requirement. The concern that patients would be taxed if they completed any registration is one of the reasons that can be identified, among other less frequent mentioned reasons.

When asked about the most frequent technical issues around Telehealth practice, the lack of information technologies adaption to the activity, particularly in public settings (n=337) when opposed to private (n=42). Technological patient illiteracy was another popular response (n=335). Less technical difficulties were reported regarding the private context. No technical difficulties were reported by 124 participants.

The most frequently mentioned clinical difficulty is the inability to accomplish physical examination (n=565), followed by difficulties in transmission to (n=275) or understanding patient complaints (n=242). No clinical difficulties were reported by 124 participants. Only five physicians believed that telehealth caused deterioration of doctor-patient relationship.

Doctors reported satisfaction with telehealth and their perception about the effectiveness of teleconsultation when compared to in-person consultation can be consulted on table 8. Frequencies breakdown regarding the physician's system of practice can be consulted in figure 11 and 12.

Teleconsultations take less time, according to 59,5% (n=446) of the respondents, while 21,3% (n=215) said they spent the same amount of time. and only 8,8% (n=89) believed that spend more time. Merely 13,9% (n=104) doctors agreed with remote first-time appointments, whereas 75,8% agreed with follow-up teleconsultations. These data can also be consulted in table 8.

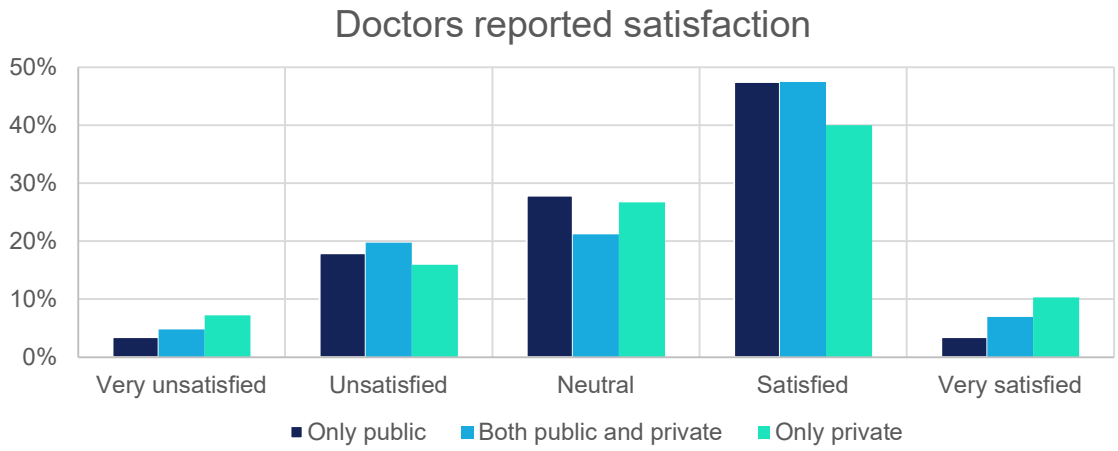

Figure 11 - Doctors reported satisfaction distribution

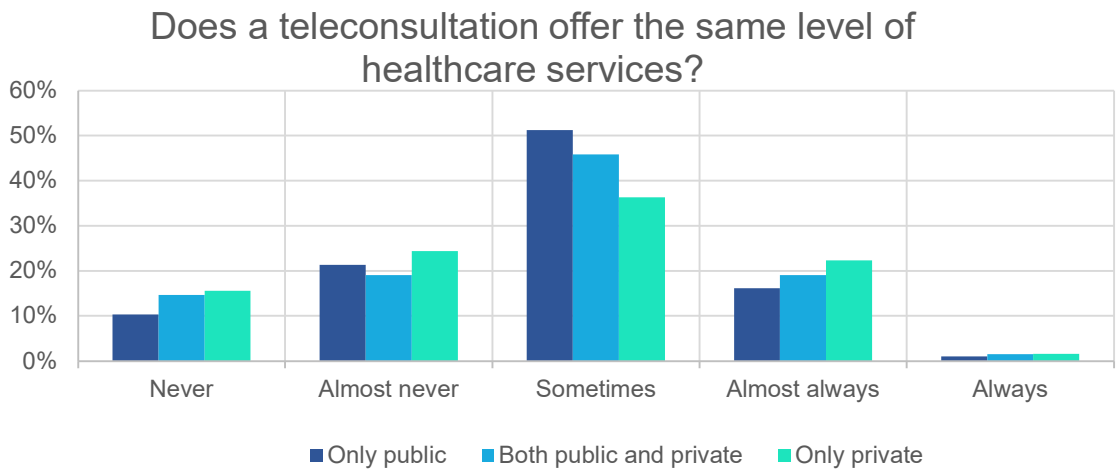

Figure 12 - Doctors perception on effectiveness of teleconsultation when compared to in-person consultation

Variables	n (%)
Describe your global satisfaction with teleconsultations.	
Very unsatisfied	37 (4,9%)
Unsatisfied	137 (18%)
Neutral	191 (25,1%)
Satisfied	346 (45,5%)
Very Satisfied	49 (6,4%)
Does Teleconsultations provide the same level of care compared to In-person consultations?	
Never	100 (13,2%)
Almost never	161 (21,3%)
Sometimes	344 (45,4%)
Almost always	142 (18,8%)
Always	10 (1,3%)
How much time, on average, did the teleconsultation take compared to in-person consultations?	
Less time	446 (59,5%)
Same time	215 (28,7%)
More time	89 (11,9%)
Are first time teleconsultations adequate?	
Yes	104 (13,9%)
No	646 (86,1%)
Are follow-up teleconsultations adequate?	
Yes	567 (75,8%)
No	181 (24,2%)

Table 8 - Physicians perceptions on teleconsultations

When asked about who should define the concept, rules and strategies for the telehealth practice on each specialty, 86,1% (n=608) believed it should be the specialty board responsibility. In alternative, the remaining participants mentioned Portuguese medical association, the department where the teleconsultation is conducted, the own doctor or other public health institution, such as General Health Direction (DGS) or Health ministry. Finally, 87,2% (n=615) participants believed patients should have the permission to ask for a teleconsultation.

When asked about suggestions for improving telehealth in Portugal, the most frequently mentioned point was the existence of a support team specifically focused on teleconsultation (n=510), closely followed by campaigns to raise awareness among patients (n=503). 469 participants agreed with the development and further improvement of a telehealth-specific digital platform, while 430 physicians agreed that spaces should be provided with the appropriate equipment to conduct teleconsultations and 368 doctors mentioned training programs for medical professionals, sharing knowledge and guidelines that will be helpful while conducting teleconsultations. It is relevant to mention that a few doctors suggested the creation of telehealth dedicated schedules on their work routine (n=9) and a few other ones mentioned that reimbursement and financing politics should be improved to potentiate telehealth practice.

3.2 Inferential analysis

Physicians' satisfaction, acceptance and future use of Telehealth

Concerning participants satisfaction, acceptance and future use of telehealth, we should focus on the 10th and 17th questions. These two questions were Likert scale like questions about these thematic. In order to enable further variations comparisons, participants answer to these questions were submitted to a factor analysis, from which it was extracted and compiled the statistically relevant components. For the 10th question, there were found 3 components, that were called “Telehealth convenience for patients”, “Telehealth convenience for doctors” and “Telehealth safety”. For the 17th questions, there were also 3

identified component, called: “Quality and user satisfaction”, “Usefulness and future use” and “Reliability”.

For the translation of TUQ into European portuguese, alpha (α) of Cronbach was 0,873, which is a elevate value, as well as the average inter-items correlation of 0, 537. Questionnaire translation was internally consistent.

To test hypothesis that sex, type of specialization, type of healthcare institution, region of practice and system of practice had a statistically significant influence in the mentioned components, independent samples *t-test* or ANOVA analysis were performed regarding these variables.

To test gender’s variable impact on the aforementioned components, it was performed an independent samples t-test between male and female groups. The complete results can be consulted in table 9.

Regarding gender, there are statistical differences between groups for "Safety" (t-value=3,491, p-value=<0,001) and "Quality and User interface” (t-value =2,082, p-value=<0,038), with male participants rating higher in both components.

Variables		Mean	SD	t value	p-value
TCP	Male	2,98	1,118	1,719	0,086
	Female	2,85	1,299		
TCD	Male	2,92	0,971	-0,592	0,554
	Female	2,91	0,928		
Safety	Male	**2,83**	0,930	3,491	**<0,001**
	Female	2,76	0,934		
Q & S	Male	**2,89**	0,720	2,082	**0,038**
	Female	2,74	0,801		
Usability & Future use	Male	3,24	0,994	0,195	0,845
	Female	3,29	0,950		
Reliability	Male	1,89	0,734	1,140	0,255
	Female	1,64	0,745		

Table 9 - t student tests between genders regarding identified components in the survey.
TCP - Telehealth convenience for patients, TCD - Telehealth convenience for doctors, Q & S – Quality and User satisfaction, SD = standard deviation

Concerning the variable “system of practice”, it was applied an ANOVA test in order to identify statistically significant variances between groups. We identified statistically significant differences in terms of “Telehealth convenience” for both doctors (F=3,403; *p-value=0,034)* and patients (F=13,909; p-value=<0,001), “Quality and user satisfaction” (F=14,289; p-value=<0,001), “Usability and Future Use” (F=3,678; p-value=<0,026) and “Reliability” (F=16,025; p-value=<0,001). The complete results can be consulted in the table 10.

Variables		Mean	SD	F	p-value
TCP	Only public	2,73	0,763	13,989	**<0,001**
	Both public and private	2,93	0,714		
	Only private	3,10	0,749		
TCD	Only public	2,97	0,948	3,403	**0,034**
	Both public and private	2,94	0,936		
	Only private	2,75	1,033		
Safety	Only public	2,84	0,677	0,978	0,377
	Both public and private	2,78	0,721		
	Only private	2,74	0,860		
Q & S	Only public	2,50	1,297	14,289	**<0,001**
	Both public and private	2,90	1,187		
	Only private	3,08	1,071		
Usability & Future use	Only public	3,26	0,864	3,678	**0,026**
	Both public and private	3,37	0,911		
	Only private	3,13	1,070		
Reliability	Only public	1,51	0,930	16,025	**<0,001**
	Both public and private	1,80	0,902		
	Only private	2,01	0,928		

Table 10 - ANOVA variance tests between groups inside variable "System of practice" concerning the mentioned components. TCP - Telehealth convenience for patients, TCD - Telehealth convenience for doctors, Q & S – Quality and User satisfaction, SD = standard deviation

Following these findings, post-hoc analyses using Scheffe’s test were carried out. In every analysis, the group “only public” were statistically different from the group “only private” or “both public and private”, while these last two were never found to be statistically different.

Another chosen variable was “Type of institution”. For this analysis, answers classified as “others” (n=8) were ignored. We identified statistically significant differences in terms of “Telehealth convenience for patient” (Z=6,705; p-value=<0,001), “Reliability” (Z=7,293; p-value=<0,001) and “Quality and User satisfaction” (Z=5,768; p-value=<0,001). The complete results can be consulted in table

Variables		Mean	SD	F	p-value
TCP	PHosp	2,83	0,786	6,705	**<0,001**
	PPC	2,82	0,732		
	Private	3,17	0,736		
TCD	PHosp	2,99	0,965	1,554	0,199
	PPC	2,85	0,959		
	Private	2,83	0,969		
Safety	PHosp	2,76	0,745	1,058	0,366
	PPC	2,76	0,728		
	Private	2,88	0,733		
Q & S	PHosp	2,71	1,264	5,768	**<0,001**
	PPC	2,69	1,223		
	Private	3,20	1,080		
Usability & Future use	PHosp	3,30	0,897	0,280	0,840
	PPC	3,30	0,912		
	Private	3,22	1,105		
Reliability	PHosp	1,70	0,918	7,293	**<0,001**
	PPC	1,60	0,939		
	Private	2,09	0,899		

Table 11- ANOVA variance tests between groups inside variable "Type of institution" concerning the mentioned components. TCP - Telehealth convenience for patients, TCD - Telehealth convenience for doctors, Q & S – Quality and User satisfaction, SD = standard deviation, PHosp – Public Hospital, PPC – Public Primary care

Considering these findings, post-hoc analyses using Scheffe’s test were also carried out. For every statistically significant different component, it was identified statistically significant differences between Public Hospital or Primary care institutions groups and private practice. There is no statistically significant difference between public hospital practitioners and primary care physicians’ opinions in the mentioned components.

Regarding the variable “Type of specialty”, the group “diagnostic specialty” was excluded from the analysis, as it was just composed by few participants. It was performed a t-student analysis between Medical and surgical specialties, being identified a statistically significant difference between the two groups in terms of the component “Usability and Future Use”, having medical specialties rated higher. The complete results of this tests can be consulted in table 12.

Finally, concerning the region of practice, it was applied ANOVA variance analysis and it was only found statistically significant differences in “Telehealth convenience for patient” component, and after the post-hoc analysis, it was not found any significant differences. The results can be consulted in table 13.

Variables		Mean	SD	t value	p-value
TCP	Medical	2,92	0,767	1,217	0,224
	Surgical	2,83	0,742		
TCD	Medical	2,93	0,958	1,848	0,065
	Surgical	2,75	1,046		
Safety	Medical	2,79	0,718	-0,328	0,743
	Surgical	2,81	0,734		
Q & S	Medical	2,85	1,220	1,751	0,08
	Surgical	2,64	1,248		
Usability & Future use	Medical	**3,32**	0,934	2,513	**0,012**
	Surgical	3,09	0,946		
Reliability	Medical	1,79	0,936	1,905	0,057
	Surgical	1,61	0,915		

Table 12 - T student tests between types of specialties regarding identified components in the survey. TCP - Telehealth convenience for patients, TCD - Telehealth convenience for doctors, Q & S – Quality and User satisfaction, SD = standard deviation

Variables		Mean	SD	F	p-value
TCP	North	2,83	0,781	2,152	**0,046**
	Center	2,95	0,693		
	LVT	2,97	0,763		
	Alentejo	2,50	1,097		
	Algarve	2,73	0,729		
	Madeira	2,57	0,808		
	Açores	3,08	0,798		
TCD	North	2,80	0,998	1,639	0,134
	Center	2,99	0,916		
	LVT	2,96	0,962		
	Alentejo	2,46	0,908		
	Algarve	3,24	0,823		
	Madeira	2,90	1,082		
	Açores	2,77	0,994		
Safety	North	2,74	0,758	1,138	0,338
	Center	2,92	0,604		
	LVT	2,77	0,770		
	Alentejo	2,69	0,902		
	Algarve	2,76	0,812		
	Madeira	2,93	0,550		
	Açores	3,00	0,577		
Q & S	North	2,72	1,226	1,072	0,377
	Center	2,83	1,168		
	LVT	2,88	1,241		
	Alentejo	2,34	1,356		
	Algarve	2,69	1,135		
	Madeira	2,35	1,435		
	Açores	2,89	1,193		
Usability & Future use	North	3,20	1,013	0,935	0,469
	Center	3,30	0,863		
	LVT	3,31	0,929		
	Alentejo	2,78	1,035		
	Algarve	3,37	0,676		
	Madeira	3,23	0,767		
	Açores	3,30	1,006		
Reliability	North	1,74	0,988	0,401	0,879
	Center	1,81	0,981		
	LVT	1,74	0,885		
	Alentejo	1,58	0,876		
	Algarve	1,71	0,881		
	Madeira	1,51	1,189		
	Açores	1,93	0,851		

Table 13 - ANOVA variance tests between groups of variable "Region of Practice" concerning the mentioned components. TCP - Telehealth convenience for patients, TCD - Telehealth convenience for doctors, Q & S – Quality and User satisfaction, SD = standard deviation, LVT – Lisboa e Vale do Tejo

4. Discussion

Once all the data have been examined, it is time to concentrate more on its discussion. There won't be an in-depth analysis of each topic as they were raised during the presentation of the results. Instead, this part will be used to compile and explain the most pertinent findings form this investigation, compare it to the contemporaneous scientifical evidence and propose some conclusions that might be helpful to decision-makers.

The number of doctors in Portugal in 2021 was 58735, which has been steadily increasing since 1991, according to the Portuguese National Statistics Institute. This is the first national survey investigating physician perceptions, satisfaction and activity regarding Telehealth in Portugal following the peak of COVID-19 pandemic, in which we accounted for more than 1,7% of all medical doctors registered in this country. It could only be retrieved from the literature two big and pertinent studies about Telehealth medical professionals' acceptance about this technology in Portugal: one from 2016 published by Ferreira and other published by O'Neill *et al.* in 2021, with data from 2020. The examination of these two studies and its correlation towards the results of our survey will be particularly beneficial in order to raise accurate awareness in these topics and establish projections about the future of portuguese telehealth. Comparing our results to other foreign studies will also be beneficial. (Ferreira, 2016; O'Neill et al., 2022)

Moving on to the discussion itself, it has already been established that the COVID-19 pandemic unleashed the employment of telehealth in practically every nation, regardless of the type of medical institution or medical specialty. In data from 2020, O'Neill *et al* discovered that, although more than 85% of clinicians had not used Telehealth before the COVID-19 pandemic, 93,8% had done so during the pandemic's initial stages. (O'Neill et al., 2022) In a previous study from 2016, Ferreira et al. found that only 28% of the participating clinicians often used telehealth. Furthermore, according to data from SPMS, after SARS-COV2 outbreak, teleconsultations spiked, reaching more than 2,2 million at the end of 2021 (just in the portuguese public system alone). However, despite at the time of conception of this dissertation, the data for 2022 is only available until July 2022, it is a fact that the number of teleconsultations has decreased by 43,2% when

compared to the same period in 2021 (~875.000 in 2021 vs ~496.000 in 2022). However, the number of teleconsultations in 2022 is still seven times higher than in the same period in 2019 (~67000 in 2019 vs ~496000 in 2022). Our study identified a lower proportion of Telehealth regular practicing doctors (only 69,8% had performed at least one teleconsultation in the preceding 6 months), than those identified 2 years earlier at O'Neill *et al* investigation.

Various factors may have played a role in this decrease when compared to 2020/2021. Firstly, after covid mass vaccination and lower levels of infection, lockdown has come to an end in the beginning of 2020. During the pandemic's lockdown, there was strong pressure to replace fundamental health services with telehealth services, due to the necessity to keep patients away from healthcare institutions, identified vectors and foci of disease. A great portion of telehealth efforts were established out of necessity rather than following a structured strategy with predetermined goals and outcomes. Additionally, they were designed to cover a broad range of acute and chronic disorders with little thought given to which conditions would be best suited for a remote consultation module. Due to the lack of a robust structure, motif and strategy, many telehealth programs might have failed to persist and consultations returned to their routine configurations as soon as it was desirable in-person consultations to come back. The lack of adequate infrastructure or equipment to continue with teleconsultations, patient and/or professional dissatisfaction with the service, better perceived outcomes attributed to in-face consultations, among other factors, might be some reasons to this ending. (Hollander & Carr, 2020b)

However, it should not be implied that Telehealth will begin to decrease to before pandemic levels. It is the opposite. According to a study by Bestsennyy *et al*, global telehealth usage peaked in April 2020 and has since decreased until it has plateaued 38 times higher than in 2019. Demand and utilization for telehealth services stabilized at lower than 2020/2021 but still-very high levels. (Bestsennyy et al., 2022)

In general, doctors that are younger tend to be more technologically savvy and, therefore, more comfortable using telemedicine. Our findings corroborate this, although doctors younger than 35 years old reported to perform less teleconsultations than the 36 to 45 years old group, as well as resident doctors performed fewer remote consultations than specialists. That might be explained by

the fact that the type of consultation performed by both groups might be a little bit different. Resident doctors tend to consult more acute health problems, especially from the emergency department or ward, while specialists might have a higher rate of chronic patients that can be followed remotely, based on laboratorial analysis and imaging.

Another contributing factor for Telehealth usage might be the type of medical institution where the patient care is ministered. Our study reported a higher telehealth practice among primary care physicians than hospital-based doctors (95% for primary care practitioners, 81,2% for Central Hospitals and 79.9% for peripheral ones). These results are in line with other published studies during pre-COVID or during COVID reality. When compared to hospital specialist doctors, primary care physicians (PCPs) tend to consult less acute or severe disorders and thus, often perform more follow-up visits than other specialties. Therefore, the percentage of in-person consultations convertible to telehealth consultations is higher. The fact that PCPs were and are still in charge of monitoring mild to moderate COVID-19 patients in provides another compelling argument to their higher telehealth practice rates. (Beheshti et al., 2022)

The most often reported method of communication between the doctor and the patient was still phone call. However, in terms of videoconsultation, our research identified a three times higher usage of video-support, while the majority of doctors reported videoconsultation isa valuable tool in at least some consultations. Additionally, we discovered that doctors who solely practiced privately believed video-supported teleconsultation was clearly more advantageous and should be used more frequently.

Although telephone consultations might be equally effective in saving patient expenditures associated with hospital visits and eliminate unneeded travel, they are, in opposition to videoconsultations, hampered by poor non-verbal communication. There is evidence that video-based consultations can produce better outcomes than phone-based consultations. In 2019, for the primary healthcare context, Donaghy *et al* claimed that contrary to telephone consultations, the visual aspect of videoconsultations offers clear advantages, such as the possibility of showing empathy, giving visual clues or non-verbal tips, or building confidence in the patient. In general, video was considered to enhance communication. The same study documented technical issues, such

as unstable internet connections or poor video resolution, being the widespread provision of robust and high-quality video solutions is crucial for the general use and acceptance of videoconsultations. (Donaghy et al., 2019; Randhawa et al., 2019) A study form Capampangan *et al*, specifically developed around the telestroke context, evaluated the clinical outcomes between video-supported referrals against telephone-based ones. Videoconsultation enabled better sensitivity, specificity and positive and negative predictive values than teleconsultation in assessing thrombolysis eligibility for acute stroke patients who do not have immediate access to a stroke neurologist. Handschu *et al* identified similar findings regarding telestroke. (Capampangan et al., 2009; Handschu et al., 2008). Another study from Ignatowicz et al. identified that, especially physicians are satisfied with videoconsultations. (Ignatowicz et al., 2019)

In conclusion, it is encouraging to discover that doctors in Portugal are more familiar and supportive for videoconsultation since, in the long term, this is anticipated to lead to greater mutual satisfaction with the telehealth services and increased demand and usage.

It is also important to mention that a few practitioners documented telemonitoring initiatives, which may be a fresh yet powerful type of telehealth communication in the future. It is still very premature, but as stated in the introduction, with the technological advancement of wearables and the widespread adoption of the Internet of Things' interconnectivity principles, it will generate a sea of data and, when properly interpreted, have a tremendous impact on the outcomes of chronic diseases.

Regarding the most used software for videoconsultations, participants preferred to use video conferencing tools that weren't created specifically for this purpose, such WhatsApp, Zoom, Microsoft Teams or Skype. Various reasons might have led to this outcome. Firstly, one of the barriers to telemedicine mentioned in the introductory chapter is the inability of the patient and doctor to adapt to the applicable technologies due to a lack of technological literacy or a lack of adequate equipment (i.e., appropriate hardware). Doctors began employing software that they are most familiar with as a solution, such as WhatsApp or Zoom. In the other hand, these software technologies are also commonly used by patients. This poses as a simple solution for both stakeholders. Recent investigations have demonstrated that, in the case of WhatsApp, clinical outcomes

were comparable to the other communication channels. (Barayev et al., 2021) However, WhatsApp poses some risks too. In a 2021 survey conducted by Barayev et al, medical practitioners mentioned that WhatsApp was the increased workload, both during and after work hours. WhatsApp permits unregulated patient invasion into the doctor's personal life. (Barayev et al., 2021) On another hand, there is no interoperability between WhatsApp and patient's EHR. Important clinical information might not be included in patients' clinical data, which may facilitate liability problems. An important matter when addressing patient confidentiality is that even though WhatsApp advertises end-to-end encrypted communications, the system is not HIPAA (Health Insurance Portability and Accountability Act) consistent because of privacy concerns (messages can be shown in a smartphone's locked screen, for example). This is a crucial point to note while discussing patient confidentiality. Additionally, since WhatsApp mainly backs up local copies of messages and files, doing so could jeopardize future pertinent documentation. (Martínez-Pérez et al., 2015; Zhou, Bao, Watzlaf, et al., 2019)

RSE Live, the official videoconsultation tool of the Portuguese government, was only allegedly utilized by 9 participants. This demonstrates that in order to boost utilization, SPMS may need to maintain enhancing the platform's improvement as well as its marketing and training efforts, for both doctors and patients.

The normal individual consultation room was the most frequently indicated location for teleconsultations in both public and private practice, which agrees with telemedicine norms and general medical privacy principles. It is also in line with O'Neill et al investigation. However, there is still important problems for portuguese telehealth in terms of location First, only a very small percentage of doctors reported having a room exclusively dedicated to telehealth. Additionally, the high proportion of participants who use telehealth in a shared room poses as a significant privacy risk.

Since teleconsultation was regularly used without any forethought or planning, it raises several difficulties. At the technical level, participants brought up issues with physicians, patients, or caregivers' capacity to adapt to technology, as well as the lack of suitable or essential equipment. The last one might be solvable with financial and educational investments. However, it will be more challenging to

overcome patient/caregiver inadaptation since it will need deep society changes and adaptations.

Moving on into the analysis and discussion of inferential statistical findings, gender was only found to significantly impact perceived “Patient safety” and “Quality and user satisfaction” levels. Contrarily, in a 2022 study published by Neshnash *et al*, physician gender was not found to have any statistically significant impact on user satisfaction. (Neshnash et al., 2022) In our investigation, we didn’t find out any statistically significant difference regarding “Usability and future Use”. However, Guma *et al* published a 2021 study where female doctors reported being more willing to use telemedicine in their practices in the future. (Guma et al., 2021) This could be anticipated since more female doctor practice part-time medicine or want more schedule flexibility. A study from Lachish *et al* found that 42% of UK female doctors worked less than full time hours (LTFT), while only 7% of male participants do so. Familiar reasons were the most reported to justify this variation. For instance, child-rearing duties dramatically affected the female physicians’ likelihood to work LTFT but had no impact in male doctors. (Lachish et al., 2016) This finding is not just important in the Telehealth context but should also be considered by healthcare-dedicated human resources management teams. Considering the rising proportion of women working in the medical field, ignoring these identified characteristics will bring significant burden into healthcare systems. It is important for healthcare governance stakeholders to consider workplace flexibility as an opportunity to bring more satisfaction and less burnout rates into female practitioners. Since our results didn’t demonstrate this, confirmatory future longitudinal studies could be used to re-test this. It would also be interesting to investigate willingness to use telehealth by doctors with concomitant academic or investigation careers and burnout incidence when compared to telehealth usage.

Regarding the system of practice, perceived “Telehealth convenience for patient”, “Telehealth convenience for doctor”, “Quality and User satisfaction”, “Usability and Future Use” and “Reliability” were all statistically different between groups, while private-exclusive or physicians working in both systems outperformed public system-exclusive doctors. Since reimbursement and healthcare funding techniques are highly different based on nation and that public

and private healthcare providers don't coexist in every county, there is no extensive volume of information to support this assertion. However, it is a reality that private investors began funding private telehealth initiatives as they anticipated the significant shift toward telehealth and the rise in demand. Investment in virtual health continues to accelerate. The year of 2021 saw a total venture capital investment into the digital health sector of 29,1 billion dollars, which doubled the whole investment in 2020 (14.6 billion) and quadrupled the investment in 2019 ($7.7 billion), according to Rock Health's 2021 digital health funding report. And, although it is anticipated to decrease slightly in 2022, these values are incredibly high. (Nagappan et al., 2022) A lot of this investment will turn into better telehealth solutions, that are much more likely to be used in the private sector, since Portugal's public system is struggling to finance essential healthcare supplies and human resources. Therefore, a higher private investment in telehealth might be the cause of our study's reported findings.

The same justifications may justify differences found concerning the type of institutions physicians more frequently worked on, since public hospitals or primary care institutions rated less than private institutions in terms of "Quality and User satisfaction" and "Reliability". There is also a significant difference in terms of "Telehealth convenience for Patient". This can be due to the belief that better quality and physician satisfaction might be linked to better convenience and results to the patient. Existent literature doesn't support these findings. There was no difference between public hospitals and public primary care facilities since both would benefit from telehealth.

Last but not least, medical specialties scored higher on "Usability and Future Use" than surgical specialties. In fact, these findings are in line with numerous studies and market studies predict that telehealth will continue to gain traction in the delivery of healthcare services, although at distinct rates in different specialization areas. Bestsennyy *et al* concluded that, in accordance with our data, medical specialties continued to show the greatest interest in offering remote medical consultations, in 2021. (Bestsennyy et al., 2022) For instance, in the mentioned study, psychiatrists have reported that telehealth accounted for 50% of their appointments, followed by endocrinology and rheumatology, while bottom specialties were General Surgery, Orthopedics and Ophthalmology. Between surgical specialties, Urology is repeatedly reported as the one performing more

remote medical appointments as well as in the mentioned study. (Chao et al., 2021; Kane & Gillis, 2018) There is also the evidence that, when compared to other specializations, surgical disciplines were less likely to use telemedicine before the pandemic and that surgical telehealth conversion rates were low.

This may be justified by some possible obstacles to the implementation of surgical telehealth. Physical examination is frequently used to diagnose patients and set their course of treatment, while in some medical specialties it can be frequently less essential in some types of consultations, especially chronic diseases routine consultations. Many surgeons can thus view Telehealth as risky or ineffective to their activity. This is a strong barrier for surgical specialties. (Chao et al., 2021; Kane & Gillis, 2018) More research is needed regarding telehealth in the context of surgical specialties. However, might be possible to investigate and create clinical algorithm, that can reorientate some patients into a hybrid management workflow, in particular identified settings. Telehealth is also anticipated to have potential benefits in the preoperatory and post-operatory phases. (Ferrari-Light et al., 2020)

Limitations

After most of the findings in this dissertation have already been presented, it is particularly appealing to analyze the major limitations identified, not just to assist the reader in comprehending a few of the orientations followed by the investigation, as well as to offer additional hints to researchers in this area about potential challenges they may need to overcome. These limitations might also be the trigger for following investigations in this area.

Most of reported limitations are frequent survey creation and delivery limitations. Firstly, online methods, such as email, were the only delivery methods used to disseminate the survey into the target population. Therefore, this might possibly be a source of a selection bias, since questions were only addressed to doctors already minimally familiarized with information technology. This study did not reach doctors that are not familiar with electronic email, that might as well not be familiar with telehealth, thus possibly overestimating the identified proportion of doctors practicing telehealth and their satisfaction with this method.

Secondly, this investigation was designed as a cross-sectional study, set to analyze a specific population (portuguese doctors) in a certain period. Due to that, the sample was not randomized and some circumstances, such as the degree of knowledge about telemedicine or the existence of a history of highly positive or negative experience with telehealth (recall bias), may have affected how motivated certain individuals were to respond to this survey. There might be significant differences between responders and non-responders (participation bias). (Wang & Cheng, 2020) However, this investigation obtained a substantial number of valid participations, from different specialties, healthcare institutions, regions and healthcare systems (public vs private). This is last topic is also a strength as most investigations developed for the portuguese setting (such as O'Neill *et al*) have only focused on the public healthcare system, ignoring that private practice is as well an important stakeholder in telehealth ecosystem. (Pimentel, 2019)

Third, in open text boxes, a very low response rate was achieved. This can be explained by the fact that physicians are frequently too busy and that only a small number of participants were sufficiently motivated to record their views. This may cause participants to have answered question only based on the predetermined multiple-choice questions, while they have slightly different convictions about the inquired topic.

Fourth, many of the items in our survey employ a Likert scale, which is typically, particularly when it is used meticulously, a significant source of bias. As an illustration, central tendency bias occurs frequently because of the subject's aversion from delivering extreme outlying answers. Sometimes, Likert scales can also generate acquiescence bias, that is an agreement with the given statements, to refrain controversy. (Pimentel, 2019)

As stated in the theoretical introduction, the terms "telehealth," "e-health," "telemedicine," and "digital health" are frequently interchangeable. It's possible that some participants will have different notions about what constitutes a telehealth act. Different levels of understanding about this topic have a significant role in certain found discrepancies. Results significancy on future studies will be improved by increasing awareness about this topic.

The fact that physicians regularly alternate between public and private practice in Portugal is another significant limitation. For instance, 33,3% of our participants worked in both systems. It is probable that they use telemedicine in

both public and private systems, while they might have different opinions, perceptions and satisfaction rates between different settings. Although this survey's questions were developed keeping it in consideration, some bias might have been introduced by this particularity.

In conclusion, regarding the mentioned limitations, it is crucial to conduct more research to validate or update these findings. Longitudinal studies could be developed to corroborate these discoveries. Additionally, apart from investigating telehealth demand or usage, its frequent usage will enable other types of investigations. It is essential to investigate the clinical outcomes and impacts of telehealth programs, as well as to create predictive economic models and perform economic evaluations to assess telehealth programs sustainability. Although Telehealth is supposed to generally decrease healthcare expenditure, it might depend on the population and country where it is applied into. Patient safety and cybersecurity levels as well as ethical dilemmas should also be assessed. Additionally, specific studies for different specialties and pathologies should be carried out to enable the creation of targeted telehealth guidelines for different medicine fields. Since telehealth is not exclusive to doctors, studies of this kind should also include other healthcare providers to enhance the understanding of telehealth in Portugal.

5. Conclusions

The information gathered in this research offers guidance to health institutions and regulatory authorities in the development and establishment of infrastructure and systems that allow the delivery of medical care that is effective, affordable and practical via telehealth. This strategy makes it feasible to diversify healthcare solutions, increase the scale at which health care services are delivered and tailor those services to the needs of different patient types. It also helps to build robustness over contemporaneous healthcare risks and challenges.

Telehealth acceptance and spread in Portugal were boosted by the COVID-19 pandemic. After pandemic's peak, Telehealth remained a significant, widespread and frequently used solution, both in the public and private sectors. Therefore, it appears likely that Telehealth will become a common and ubiquitous practice, but it is still important to address challenges of a clinical, technological, educational, organizational, regulatory and ethical character.

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Appendix I

Impacto da Telessaúde na Prestação de Cuidados de Saúde em Portugal
Um olhar sobre a satisfação dos médicos portugueses

1. Exerce funções como médico numa instituição do SNS?
Por favor, selecione uma das seguintes opções:

- ☐1 Sim, apenas no SNS
- ☐2 Sim, no entanto, também exerço funções noutras instituições de saúde que não fazem parte do SNS
- ☐3 Não exerço funções no SNS

2. A telemedicina faz parte da sua prática clínica habitual? PRÁTICA DA TELEMEDICINA
Por favor, selecione uma das seguintes opções:

- ☐1 Sim
- ☐2 Não

3. No último semestre, realizou teleconsultas/consultas não presenciais?
Por favor, selecione uma das seguintes opções:

- ☐1 Não realizei teleconsultas/consultas não presenciais
- ☐2 Sim, menos de 20 teleconsultas/consultas não presenciais
- ☐3 Sim, entre 20 a 50 teleconsultas/consultas não presenciais
- ☐4 Sim, entre 50 a 100 teleconsultas/consultas não presenciais
- ☐5 Sim, entre 100 a 200 teleconsultas/consultas não presenciais
- ☐6 Sim, mais de 200 teleconsultas/consultas não presenciais

4. Em que espaço(s) físico(s) realizou teleconsultas/consultas não presenciais?
Por favor, selecione todas as opções que se aplicam:

- ☐1 Gabinete específico para teleconsulta, em instituição do SNS
- ☐2 Gabinete específico para teleconsulta, em instituição privada
- ☐3 Gabinete médico individual, em instituição do SNS
- ☐4 Gabinete médico individual, em instituição privada
- ☐5 Espaço de utilização comum, em instituição do SNS
- ☐6 Espaço de utilização comum, em instituição privada
- ☐7 Fora da instituição de saúde (ex. casa) - ao serviço do SNS
- ☐8 Fora da instituição de saúde (ex. casa) - ao serviço de entidade privada
- ☐9 Outra _____

5. Que forma/s de comunicação utilizou para estabelecer contacto com o utente para a teleconsulta/consulta não presencial?
Por favor, selecione todas as opções que se aplicam:

- ☐1 Chamada telefónica
- ☐2 Videochamada
- ☐3 Envio de documentos para o utente por email (ex. prescrição de exames ou medicamentos)
- ☐4 Envio de documentos para o utente por plataforma dedica à telemedicina
- ☐5 Envio de documentos para o utente por correio
- ☐6 Receção de documentos do utente por email (ex. resultados de exames complementares de diagnóstico)
- ☐7 Receção de documentos do utente por plataforma dedica à telemedicina (ex. resultados de exames complementares de diagnóstico)
- ☐8 Receção de documentos do utente por correio
- ☐9 Outra _____

6. Se respondeu "Videochamada" na última questão, que plataforma utilizou?
Por favor, selecione todas as opções que se aplicam:

- ☐1 Microsoft Teams
- ☐2 Skype
- ☐3 Zoom
- ☐4 WhatsApp
- ☐5 RSE Live
- ☐6 Medigraf
- ☐7 Outra _____

7.

	Nunca				Sempre
A. Considera que as teleconsultas devem ter suporte de vídeo?	☐1	☐2	☐3	☐4	☐5
B. Nas teleconsultas/consultas não presenciais realizou registos no processo clínico do utente?	☐1	☐2	☐3	☐4	☐5

Caso não tenha respondido "Sempre" na última questão, indique o(s) motivo(s)pelo(s) qual(is) não realizou registos no processo clínico do utente.

Por favor, selecione todas as opções que se aplicam:

☐1 Ausência de acesso ao processo clínico do utente, em instituição do SNS
☐2 Ausência de acesso ao processo clínico do utente, em instituição privada
☐3 Problemas técnicos ou logísticos, em instituição do SNS
☐4 Problemas técnicos ou logísticos, em instituição privada
☐5 Indisponibilidade para efetuar o registo, em instituição do SNS
☐6 Indisponibilidade para efetuar o registo, em instituição privada
☐7 Desconhecimento da necessidade de registo
☐8 Outra _____

8. Que dificuldade(s) técnica(s) sentiu durante a realização da teleconsulta/consulta não presencial?

Por favor, selecione todas as opções que se aplicam:

☐1 Espaço(s) físico(s) para realização de teleconsulta inadequado(s), em instituição do SNS
☐2 Espaço(s) físico(s) para realização de teleconsulta inadequado(s), em instituição privada
☐3 Inadequação das tecnologias de comunicação (ex. telefone, computador, internet), em instituição do SNS
☐4 Inadequação das tecnologias de comunicação (ex. telefone, computador, internet), em instituição privada
☐5 Impossibilidade de receber documentos do utente (ex. exames médicos), em instituição do SNS
☐6 Impossibilidade de receber documentos do utente (ex. exames médicos), em instituição privada
☐7 Impossibilidade de entregar documentos ao utente (ex. requisição de exames, receitas), em instituição do SNS
☐8 Impossibilidade de entregar documentos ao utente (ex. requisição de exames, receitas), em instituição privada
☐9 Não conseguir estabelecer uma adequada comunicação com o utente ou cuidador (ex. problema da rede móvel ou acesso à internet por parte do utente)
☐10 Dificuldade de adaptação do médico às tecnologias de comunicação
☐11 Dificuldade de adaptação do utente ou cuidador às tecnologias de comunicação
☐12 Não sinto dificuldades.
☐13 Outra _____

9. Que dificuldade(s) clínica(s) sentiu durante a realização da teleconsulta/consulta não presencial?

Por favor, selecione todas as opções que se aplicam:

☐1 Dificuldade na compreensão da informação clínica transmitida pelo utente ou pelo cuidador
☐2 Dificuldade na transmissão da informação clínica ao utente ou cuidador
☐3 Impossibilidade de realizar o exame físico
☐4 Impossibilidade de realizar exames complementares de diagnóstico
☐5 Não sinto dificuldades.
☐6 Outra _____

10. Para cada uma das afirmações selecione a opção que melhor exprime a sua opinião em relação à teleconsulta

Por favor, selecione uma opção em cada linha:

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente	Não sei
A. A teleconsulta permite uma adequada perceção do estado clínico do utente	☐1	☐2	☐3	☐4	☐5	☐6
B. O exame físico é fundamental em todas as consultas	☐1	☐2	☐3	☐4	☐5	☐6
C. A teleconsulta permite uma adequada transmissão da informação ao utente ou cuidador	☐1	☐2	☐3	☐4	☐5	☐6
D. A teleconsulta permite uma adequada relação médico-doente	☐1	☐2	☐3	☐4	☐5	☐6
E. A teleconsulta põe em risco a confidencialidade do ato médico	☐1	☐2	☐3	☐4	☐5	☐6
F. A utilização das tecnologias da comunicação é segura	☐1	☐2	☐3	☐4	☐5	☐6
G. A teleconsulta permite aumentara a acessibilidade do utente a cuidados de saúde	☐1	☐2	☐3	☐4	☐5	☐6
H. A teleconsulta permite diminuir o tempo de consulta	☐1	☐2	☐3	☐4	☐5	☐6

	Discordo totalmente	Discordo	Não concordo nem discordo	Concordo	Concordo totalmente	Não sei
I. A teleconsulta permite maior flexibilidade de horário do médico	☐1	☐2	☐3	☐4	☐5	☐6
J. A teleconsulta é mais conveniente para o médico em comparação com uma consulta presencial	☐1	☐2	☐3	☐4	☐5	☐6
K. A teleconsulta é mais conveniente para o utente em comparação com uma consulta presencial	☐1	☐2	☐3	☐4	☐5	☐6

11. Descreva o seu nível de satisfação global em relação às teleconsultas/consultas não presenciais que realizou?

Por favor, selecione uma opção:

Muito insatisfeito(a) ☐1 ☐2 ☐3 ☐4 ☐5 **Muito satisfeito(a)**

12. A teleconsulta providencia igual qualidade de cuidados de saúde em comparação com uma consulta presencial?

Por favor, selecione uma opção:

Nunca ☐1 ☐2 ☐3 ☐4 ☐5 **Sempre**

13. Da sua experiência, quanto tempo, em média, despendeu com a teleconsulta/consulta não presencial, em comparação com a consulta presencial?

Por favor, selecione uma opção:

☐1 Menos tempo
☐2 O mesmo tempo
☐3 Mais tempo

14. Acha adequado realizar primeiras consultas por teleconsulta/consulta não presencial?

Por favor, selecione uma opção:

☐1 Sim
☐2 Não

15. Acha adequado realizar consultas subsequentes por teleconsulta/consulta não presencial?

Por favor, selecione uma opção:

☐1 Sim
☐2 Não

CONSIDERAÇÕES FUTURAS

16. Que condição(ões) considera necessária(s) para facilitar a implementação da teleconsulta?

Por favor, selecione todas as opções que se aplicam:

☐1 Existência de espaço físico adequado para teleconsulta
☐2 Disponibilização de plataforma específica para teleconsulta
☐3 Existência de equipa de suporte dedicada à teleconsulta (ex. administrativo, informático)
☐4 Ações de formação aos médicos sobre técnicas e tecnologias para teleconsulta
☐5 Campanha de sensibilização aos utentes para teleconsulta
☐6 Outra _____

17. Para cada uma das afirmações selecione a opção que melhor exprime a sua opinião em relação à teleconsulta

Por favor, selecione uma opção em cada linha:

	Discordo totalmente						Concordo plenamente
A. A teleconsulta melhora o acesso a serviços de saúde	☐1	☐2	☐3	☐4	☐5	☐6	☐7
B. A teleconsulta poupa o tempo de deslocação a uma instituição de saúde	☐1	☐2	☐3	☐4	☐5	☐6	☐7
C. A teleconsulta é capaz de suprir as necessidades de cuidados de saúde da população	☐1	☐2	☐3	☐4	☐5	☐6	☐7
D. É fácil de utilizar o(s) sistema(s) de teleconsulta	☐1	☐2	☐3	☐4	☐5	☐6	☐7
E. É simples aprender a utilizar os sistemas de teleconsulta	☐1	☐2	☐3	☐4	☐5	☐6	☐7
F. Eu acredito que a teleconsulta aumenta a minha produtividade	☐1	☐2	☐3	☐4	☐5	☐6	☐7
G. A interação com os sistemas de teleconsulta é agradável	☐1	☐2	☐3	☐4	☐5	☐6	☐7
H. Eu gosto de utilizar o(s) sistema(s) de teleconsulta	☐1	☐2	☐3	☐4	☐5	☐6	☐7
I. O(s) sistema(s) de teleconsulta são simples e fáceis de compreender	☐1	☐2	☐3	☐4	☐5	☐6	☐7
J. O(s) sistema(s) de teleconsulta permite(em) realizar aquilo que seria expectava que realizasse(em)	☐1	☐2	☐3	☐4	☐5	☐6	☐7
K. Eu consigo falar com o utente facilmente utilizando o(s) sistemas(s) de teleconsulta	☐1	☐2	☐3	☐4	☐5	☐6	☐7
L. Eu consigo ouvir o utente facilmente utilizando o(s) sistemas(s) de teleconsulta	☐1	☐2	☐3	☐4	☐5	☐6	☐7
M. Eu sinto que me consigo expressar facilmente através de teleconsulta	☐1	☐2	☐3	☐4	☐5	☐6	☐7
N. Usando o(s) sistema(s) de teleconsulta, eu consigo ver o utente tão bem como presencialmente	☐1	☐2	☐3	☐4	☐5	☐6	☐7
O. As consultas realizadas utilizando o(s) sistema(s) de teleconsulta são sobreponíveis às consultas presenciais	☐1	☐2	☐3	☐4	☐5	☐6	☐7
P. Sempre que erro utilizando o(s) sistema(s) de teleconsulta, é-me fácil e rápido recuperar a conexão	☐1	☐2	☐3	☐4	☐5	☐6	☐7
Q. O(s) sistema(s) de teleconsulta dão mensagens de erro que claramente informam como resolver o problema	☐1	☐2	☐3	☐4	☐5	☐6	☐7
R. A teleconsulta é uma forma de prestação de cuidados de saúde aceitável	☐1	☐2	☐3	☐4	☐5	☐6	☐7
S. Eu realizarei teleconsultas de novo no futuro	☐1	☐2	☐3	☐4	☐5	☐6	☐7
T. De forma geral, estou satisfeito com o(s) sistemas de teleconsulta que utilizo	☐1	☐2	☐3	☐4	☐5	☐6	☐7

18. Entende que o Colégio da Especialidade deveria ter a responsabilidade de definir o conceito de teleconsulta da sua especialidade?

Por favor, selecione uma opção:

☐1 Sim
☐2 Não

Caso tenha respondido "Não" quem o deveria ter essa responsabilidade? _____

19. Considera aceitável que o utente possa solicitar a realização de uma teleconsulta ou consulta não presencial?

Por favor, selecione uma opção:

☐1 Sim
☐2 Não

Por fim agradecíamos que nos fornecesse alguns dados, apenas para fins estatísticos.

20. Qual é o seu sexo? DADOS PESSOAIS

Por favor, selecione uma das seguintes opções:

☐1 Masculino
☐2 Feminino
☐3 Prefiro não dizer

21. Qual é a sua idade? _____ anos

22. Indique o seu grau de diferenciação médica.

Por favor, selecione uma das seguintes opções:

☐1 Chefe de Serviço/Coordenador
☐2 Médico especialista
☐3 Médico Interno de Formação Específica
☐4 Médico Interno de Formação Geral
☐5 Outra: _____

23. Indique a região na qual exerce a maior parte das suas funções.

Por favor, selecione uma das seguintes opções:

☐1 Norte
☐2 Centro
☐3 Lisboa e Vale do Tejo
☐4 Alentejo
☐5 Algarve
☐6 Região Autónoma da Madeira
☐7 Região Autónoma dos Açores

24. Indique a tipologia de instituição de saúde na qual exerce a maior parte das suas funções.

Por favor, selecione uma das seguintes opções:

☐1 Hospital Central
☐2 Hospital Distrital
☐3 Unidade Local de Saúde (ULS)
☐4 Unidade de Saúde Familiar (USF)
☐5 Unidade de Cuidados de Saúde Personalizados (UCSP)

25. Indique a sua especialidade.

Por favor, selecione uma das seguintes opções:

☐1 Anatomia Patológica
☐2 Anestesiologia
☐3 Angiologia e Cirurgia Vascular
☐4 Cardiologia
☐5 Cardiologia Pediátrica
☐6 Cirurgia Cardíaca
☐7 Cirurgia Cardiotorácica
☐8 Cirurgia Geral
☐9 Cirurgia Maxilo-Facial
☐10 Cirurgia Pediátrica
☐11 Cirurgia Plástica Reconstrutiva
☐12 Cirurgia Torácica
☐13 Dermato-Venereologia
☐13 Doenças Infeciosas
☐14 Endocrinologia e Nutrição
☐15 Estomatologia
☐16 Farmacologia Clínica
☐17 Gastroenterologia
☐18 Genética Médica
☐19 Ginecologia/Obstetrícia
☐20 Hematologia Clínica
☐21 Imunoalergologia
☐22 Imunohemoterapia
☐23 Medicina Desportiva
☐24 Medicina do Trabalho
☐25 Medicina Física e de Reabilitação
☐26 Medicina Geral e Familiar
☐27 Medicina Intensiva
☐28 Medicina Interna
☐29 Medicina Legal
☐30 Medicina Nuclear
☐31 Nefrologia
☐32 Neurocirurgia
☐33 Neurologia
☐34 Neurorradiologia
☐35 Oftalmologia
☐36 Oncologia Médica
☐37 Ortopedia
☐38 Otorrinolaringologia
☐39 Patologia Clínica
☐40 Pediatria
☐41 Pneumologia
☐42 Psiquiatria
☐43 Psiquiatria da Infância e da Adolescência
☐44 Radiologia
☐45 Radioncologia
☐46 Reumatologia
☐47 Saúde Pública
☐48 Urologia
☐49 Outra _____

O PREENCHIMENTO DE QUESTIONÁRIO TERMINOU. MUITO OBRIGADO PELA SUA IMPORTANTE PARTICIPAÇÃO

CEISUC | CENTRO DE ESTUDOS E INVESTIGAÇÃO EM SAÚDE UNIVERSIDADE DE COIMBRA

DECLARAÇÃO

O Centro de Estudos e Investigação em Saúde da Universidade de Coimbra declara que conhece e respeita as regras nacionais e internacionais de ética da investigação no domínio da saúde e que o projeto apresentado à Comissão de Ética da Administração Regional de Saúde do Centro, IP, denominado "Impacto da Telessaúde na Prestação de Cuidados de Saúde em Portugal", respeita os princípios éticos fundamentais.

18 de maio de 2022

Presidente da Direção do CEISUC

Appendix II

Relationship between the number of teleconsultations in the last six months and some pertinent variables (gender, age, type of specialty, degree of differentiation, type of institutions, system of practice)

Variables		No TC	<20 TC	20 - 50	50 - 100	100 - 200	>200
Gender	Male	22,3%	32,9%	21,9%	7,1%	6,7%	9,2%
	Female	11,3%	33,9%	23,6%	11,1%	9,5%	10,6%
Age	<35 years	14,1%	33,9%	19,8%	11,5%	12,0%	8,9%
	36 to 45 years	9,4%	31,8%	25,9%	9,4%	9,4%	14,1%
	46 to 55 years	15,5%	40,2%	17,5%	5,2%	7,2%	14,4%
	56 to 65 years	17,6%	33,6%	26,7%	12,2%	3,8%	6,1%
	Over 65 years	30,6%	31,5%	20,7%	5,4%	6,3%	5,4%
Type of specialty	Medical	12,2%	34,1%	23,1%	10,4%	8,7%	11,5%
	Surgical	26,2%	37,3%	19,8%	5,6%	8,7%	2,4%
Differentiation degree	Resident doctor	18,1%	37,1%	20,0%	9,5%	10,5%	4,8%
	Specialist doctor	14,2%	35,7%	22,0%	9,2%	8,2%	10,8%
	Coordinater/chief	21,0%	27,3%	24,5%	9,8%	7,7%	9,8%
Type of institution	Central Hospital	18,8%	45,8%	19,3%	6,3%	6,8%	3,1%
	Peripheric hospital	20,1%	31,4%	25,2%	7,5%	8,8%	6,9%
	Primary Care	4,7%	21,5%	24,4%	15,7%	15,1%	18,6%
System of practice	Only public	26,1%	28,7%	18,4%	8,9%	8,7%	9,2%
	Only private	38,2%	28,3%	15,4%	5,1%	2,6%	10,3%
	Public and private	22,5%	30,9%	21,3%	9,9%	7,2%	8,1%