

# Impact of telemedicine on home healthcare: an empirical analysis

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The adoption of new patient treatment initiatives has been necessitated by the current pandemic crisis and the need for social distancing to protect doctors and patients. The main initiatives to respond pandemic crisis is the adoption of telemedicine tools which provides for the diagnosis or medical service provided by a doctor to patients in digital mode. The aim is the remote monitoring of patients' health status, allowing direct involvement of patients at home. On these premises, this study offers a mapping of the digital solutions adopted in the Calabria region by health organizations during the Covid-19 pandemic with the aim of specifically analyzing the role of telemedicine in supporting home healthcare during the Covid-19. This study provides insights into the potential of telemedicine to support home healthcare, as a response to the Covid-19 crisis now and in the future.

**Keywords:** ICT, E-health, Telemedicine, Home healthcare, Digital solutions, Covid-19.

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## **Impatto della telemedicina sull'assistenza sanitaria a domicilio: un'analisi empirica**

*L'adozione di nuove iniziative per il trattamento dei pazienti è stata resa necessaria dalla corrente crisi pandemica e dalla necessità di distanziamento sociale per proteggere medici e pazienti. La principale iniziativa per rispondere alla crisi pandemica è l'adozione di strumenti di telemedicina che permettono la diagnosi o la fornitura di servizi medici da parte di un medico ai pazienti in modalità digitale. L'obiettivo è il monitoraggio remoto dello stato di salute dei pazienti, consentendo il coinvolgimento diretto dei pazienti a casa. Su queste premesse, questo studio offre una mappatura delle soluzioni digitali adottate nella regione Calabria da parte delle organizzazioni sanitarie durante la pandemia da Covid-19, con l'obiettivo di analizzare specificamente il ruolo della telemedicina nel supportare l'assistenza domiciliare durante il Covid-19. Questo studio fornisce approfondimenti sul potenziale della telemedicina nel sostenere l'assistenza domiciliare, come risposta alla crisi da Covid-19, ora e in futuro.*

**Parole chiave:** ICT, sanità elettronica, telemedicina, assistenza sanitaria a domicilio, soluzioni digitali, Covid-19.

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## S O M M A R I O

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## 1. Introduction

The current Covid-19 pandemic has resulted in a paradigm shift around the world in how doctors communicate and consult with their patients. Due to lockdown and restrictions within various countries, doctors are adopting virtual consultation via telecommunication technologies for the treatment of patients (Nweke *et al.*, 2021).

Therefore, Information Communication Technology (ICT) tools play a key role in keeping doctors informed about up-to-date health management and recommendations (Bokolo *et al.*, 2021).

Doctors are now leveraging the capabilities of ICT to implement innovative tools to support the delivery of healthcare to patients.

Haxhihamza *et al.* (2020) and Ramaswamy *et al.* (2020) state that there is a growing interest in adopting telemedicine to provide health care, especially due to the pandemic. Telemedicine, introduced in the early 20th century, involves the use of telecommunications and online technologies, including mobile devices and computers, for the provision of health care or services; it reduces patient and doctors' exposure, helps limit the use of personal protective equipment, and reduces the backlog of delayed patient care due to the Covid-19 situation. Also, due to the current state of Covid-19, most patients prefer telemedicine as a means of treatment mainly out of fear of exposure in hospitals and medical centers (Bokolo, 2021).

Telemedicine can provide appropriate access to routine care without exposing frail patients to congested hospital waiting rooms; can help physicians conduct remote physical examination

maneuvers using image and audio acquisition devices to evaluate pulmonary, cardiac, and dermatological systems (Watson *et al.*, 2020).

On this basis, the study analyzes the support that telemedicine can provide to home health care through a mapping of the ICT tools and digital solutions adopted in the Calabria region by health organizations during the pandemic.

We present the remainder of this study as follows: after this introduction (i), the main theoretical elements on telemedicine and barriers on ICT are discussed (ii). Following, the methodological steps of the systemic literature review and the data collection process are illustrated (iii). Finally, the main conclusions, implications, limitations and suggestions for future research are presented (iv).

## 2. Theoretical background

### 2.1. Telemedicine and its benefits

In recent years, healthcare has been witnessing that is increasingly evolving towards preventive medical services for the management of personal health throughout life. The fusion of health care with ICT, is leading to the development of various new medical services and devices. These devices provide services such as telemedicine, health information exchange, and precision medicine (Shaikh *et al.*, 2009; Kim *et al.*, 2020).

In fact, digital health (or e-health) represents a trend and refers to a multiplicity of tools and technologies that make possible new remotely accessible services including those of telemedicine.

National Institutes of Health (2021) defines telemedicine as the use of

telecommunications and technology services to provide and support remote medical care with the main objective of facilitating access to treatments while avoiding hospitalization.

Telemedicine bases its technological foundations on the use of telecommunication networks and tools to manage methods and practices for the exchange of data, signals, images and reports. These perspectives recognize a profound organizational innovation and cultural adaptation to new operating methods, as well as centering activities on the application of information technologies in the field of Medicine.

According to Wilson *et al.* (2015) this is a definition that has been widely adopted by health care providers and systems around the world.

Telemedicine can include synchronous mode (real-time audio or audiovisual interaction), asynchronous mode (messages or images exchanged via a patient portal) or remote patient monitoring.

Wilson *et al.* (2015) state that synchronous or real-time systems support immediate interaction and the response occurs within a timeframe that all participating parties would find an acceptable period for them to wait, typically not more than a few minutes. The major advantage of a synchronous approach is the efficiencies because you have the opportunity to refine details pertinent to the care episode during the session, by seeking additional information or data, and in many cases providing a clinical decision or advice within the session. The typical video-consultation between a doctor and patient is an example of a synchronous model.

Asynchronous or store-and-forward systems, instead, decouple the components of the interaction so that they can occur at different times, at the convenience of the participating parties. This model still allows for multiple component interactions to occur, but the effect of the time separation may add overhead of required refreshing of the episode context during this process.

The main advantages of telemedicine include improved accessibility of care, flexibility of scheduling, greater continuity of care, a reduction in the cost of care in certain situations and greater collaboration between medical service providers (Tuckson *et al.*, 2017).

Due to the Covid-19 pandemic in 2020, telemedicine has suddenly become the safest form of assistance in many cases and the only practically permitted form in others. During the pandemic, in fact, both awareness of the limits of traditional care models and the confidence placed at all levels in the enabling capabilities of digital technology increased. Thus, new solutions begin to spread that allow citizens to make easier use of booking, payment, reporting, diagnostics, monitoring and remote care services. However, not all of these areas run at the same speed and the redesign of clinical paths and business practices require a profound review of the processes and skills necessary to implement them.

In fact, given the restrictions regarding direct contact with healthcare personnel and entry to hospitals, the introduction of telecommunication technologies through integrated telemedicine systems has represented an excel-

**Tab. 1** – Taxonomy for telemedicine

Performance	Definition
Televisit	Medical act in which the professional interacts remotely in real time with the patient, even with the support of a caregiver.
Medical teleconsultation	Medical act in which the professional interacts remotely with one or more doctors to talk about the clinical situation of a patient by sharing clinical data, reports, images, audio-video concerning the specific case electronically.
Medical and health teleconsultation	Healthcare activity, not necessarily medical, which consists in the request for support during the performance of health care activities and is performed by two or more people who have different responsibilities with respect to the specific case.
Teleservice by health professions	Act pertaining to the related health profession which is based on the remote interaction between the professional and patient / caregiver by means of a video call, to which the sharing of data, reports or images can be added if necessary.
Telerefertation	Report issued by the doctor who has subjected a patient to a clinical or instrumental examination whose content is typical of reports performed in person and which is written and transmitted by means of digital and telecommunication systems

Source: State-Regions Conference of 2020

lent solution to ensure the maintenance of a direct relationship between doctors and patients, as well as offering the opportunity to monitor and follow chronic patients in need of medical treatment or rehabilitation therapies.

Riva *et al.* (2015), Matamala-Gomez (2021) affirm how some technological advances, such as virtual reality, can be integrated into telemedicine systems both for rehabilitation therapies and for monitoring the state of health of patients, allowing an involvement direct of patients at home.

In Italy, the legislative framework in terms of nomenclature and definition of services in the field of 'telemedicine' dates back to 2014, when the

Ministry of Health published the "National Guidelines on Telemedicine". At that time three main categories of services were distinguished: specialist telemedicine, telehealth and tele-assistance. This taxonomy was then taken up and updated by the State-Regions and Autonomous Provinces Conference of 17/12/2020, also defining the implementation conditions for the provision and minimum service standards.

The table below shows the taxonomy for telemedicine defined in the State-Regions Conference of 2020 (Tab. 1).

Technological innovation can contribute to a reorganization of health-care system, in particular by supporting the shift of the focus of healthcare

from the hospital to the territory, through innovative care models centered on the citizen and facilitating access to services on the national territory.

The methods of providing health services enabled by telemedicine are fundamental in this sense, because they contribute to ensuring equity in access to care in remote areas, they are a support for the management of chronic conditions, a channel of access to high specialization, they can guarantee a better continuity of care through multidisciplinary comparison.

## 2.2. Barriers and success factors of telemedicine

The current pandemic has proved to be useful for seizing opportunities for growth and change.

There is a need for a modern and cutting-edge healthcare system that cannot ignore telemedicine and digital healthcare, which have fully entered the NHS and established themselves as extremely effective remote assistance tools.

The awareness among the general population that technology can be a useful support for health protection is documented by research carried out by Nomisma for UniSalute during the lockdown period which found that 67% of Italians were in favor of innovative digital solutions such as teleconsultation or medical television.

Telemedicine certainly does not replace traditional medicine but supports it with innovative, modern and efficient techniques capable of optimizing doctor-patient contact and, at the same time, allowing for significant time savings and cost reductions.

To achieve all this, however, it is nec-

essary to overcome barriers to its implementation.

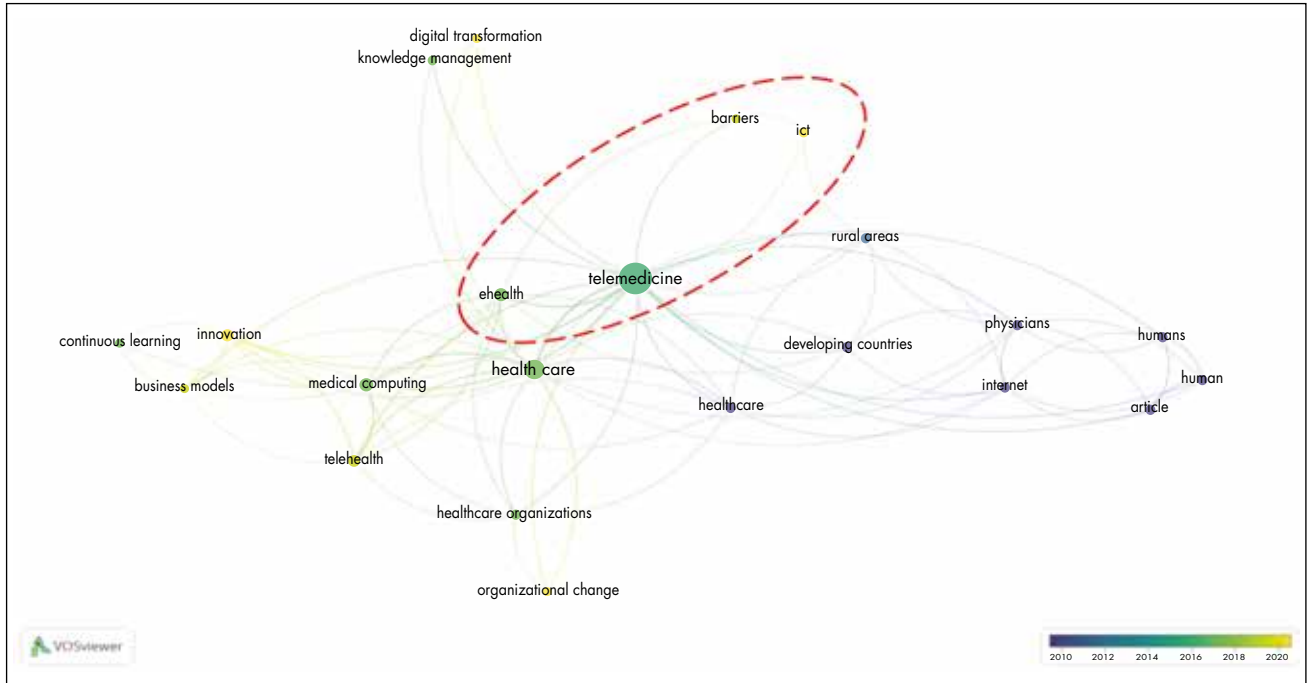
The modern academic debate is showing increasing attention to the issue of barriers to the adoption of new technologies in the healthcare sector.

Confirmation of the growing attention of scholars on this topic can be found in the construction and analysis of the scientific landscape. The scientific landscape is a graphic representation of scientific documents that analyze the phenomenon of new technologies in the health sector. Through the analysis of the scientific landscape, it is possible to understand how the scholars have analyzed the phenomenon, through the relationships between the keywords used.

Fig. 1 shows the composition of the scientific landscape on the phenomenon of telemedicine. Each node represents a keyword used by the authors of scientific documents. The scientific landscape also highlights the historical evolution of recent years, of how they have analyzed the phenomenon. From the analysis of the scientific landscape, it emerges that in the last 3 years, there has been a growing attention of scholars on the issue of “barriers” linked to the introduction of new ICT and telemedicine. In Fig. 1, the area of interest is bounded by the dashed red line.

Hyejung (2015) states that barriers can be classified as behavioral, socio-cultural, organizational, technical, economic and legal.

- 1) Behavioral barriers: if end users, patients and healthcare professionals are not comfortable with the technology, the tool is difficult to use or does not adapt to their workflow, so adoption becomes diffi-



**Fig. 1**  
Scientific landscape  
on telemedicine  
Source: Our elaboration

cult. Furthermore, the lack of training, education and technical assistance for users in telemedicine has been identified as one of the main obstacles to the effective use of advanced technological equipment and networks.

- 2) Socio-cultural barriers: not all users have the opportunity to access technologies to use telemedicine services (such as data lines, PCs, Internet...), for example all those economically weaker populations, thus causing the social divide. In addition, sometimes the use of telemedicine is only practicable for those who know the local language and this limits the ability to access these services to those who do not know or speak it fluently.
- 3) Organizational barriers: integrating telemedicine services into existing organizational structures and pro-

viding institutional support to implement these services is essential. The deficiencies in organizational communication are above all the absence of explicit strategic objectives, leadership perceived as centralized, lack of information on technology, poor planning for programming and using technology, and poor communication with medical personnel and the public;

- 4) Technical barriers: telemedicine requires systems with advanced technologies that make it possible to examine patient data in a coherent and reliable way. The ineffective and inefficient functioning of available resources is often the result of limited availability of an information network or a lack of coordination in the infrastructure and this represents a significant obstacle to the expansion of telemedicine.

5) Economic and legal barriers: reimbursement policies are one of the most important issues for the implementation of telemedicine. In particular, insurance companies, especially private ones, tend to be reluctant to pay for telemedicine services. In the long run, telemedicine success is next to impossible without adequate third-party reimbursement. Health information security issues can also be a significant obstacle to the implementation of telemedicine; therefore, hospitals must secure electronic health information and ensure limited access to such data (Fusi *et al.*, 2021).

The success factors in the implementation of telemedicine, during the Covid-19 period, were undoubtedly, the greater reliability, lower costs, better audio and video quality and the emergence of tailor-made products that mirror the workflows in the healthcare sector.

As pointed out by Greenhalgh *et al.* (2020), change does not simply consist in the installation or use of new technologies, but in introducing and supporting changes in a complex system. The implementation process is likely to prove difficult and resource-intensive and will need national and local strategy guides.

However, the use of telemedicine services can be positively or negatively influenced by external or internal factors. In fact, just think of the patient's age, the Internet line she has and the familiarity in using advanced technologies, all of these are factors that can undermine the effectiveness of online counseling.

According to the study by Almathami *et al.* (2020), younger and more famil-

iar patients with the use of digital technologies benefited from the remote service, believing that this was as effective in providing online care in the same way as a visit. in presence. However, most patients resisted online consultation, preferring face-to-face consultation. There were barriers that emerged during the service that prevented its convenient use, such as slow and malfunctioning Internet; difficulty explaining your symptoms to your doctor due to poor audio and/or video quality; resistance to technology by patients; difficulty in using the platform; patients did not feel comfortable; issues related to security policies; Difficulty on the part of doctors to organize face-to-face and online visits with a consequent increase in workload. Respondents stated that the success of telemedicine is still hampered by licensing, credentials and data protection issues, as well as cost, billing and reimbursement issues (Rogove *et al.*, 2012).

### 3. Methodology

The complex and dynamic nature of the Covid-19 pandemic has imposed a qualitative character with an exploratory and descriptive approach to the methodology of this study. The qualitative nature of the methodology has been privileged as it allows for an extensive understanding and framing of the general dynamics of the phenomenon (Eisenhardt, 1989; Yin, 1994; Sinkovics, 2016).

This study is based on a methodological process divided into two phases. The first phase – of an exploratory nature – aims to understand the main digital solutions used to respond to the pandemic crisis from Covid-19 by the health organizations of the Cal-

abria Region. Various sources of data and information were used at this stage. In particular, the websites and corporate documents of health organizations, used during the phase of the Covid-19 pandemic, were consulted. The public health structures belonging to the health sector of the Calabria region were analyzed.

Furthermore, the data collected was integrated with the data collected in the ALTEMS Covid19 Instant Reports “Analisi dei Modelli Organizzativi di Risposta al Covid-19 – Analysis of Organizational Models of Response to Covid-19” (available <https://altems.unicatt.it/altems-covid-19>). It is a summary report of the response to the spread of the virus, which with a wealth of data and graphs has compared the response of the various organizational and institutional models adopted by the Italian Regions and the different results obtained during the pandemic period.

The plurality and variety of sources made it possible to identify 26 digital solutions adopted by health organizations in the Calabria region. The detection and monitoring of digital solutions took place over a year, which began in October 2020 and ended in September 2021. The monitoring of the digital solutions identified took place monthly.

The second phase – of a descriptive nature – aims to analyze the characteristics of the individual digital solutions identified. All the data of the digital solutions was collected in an Excel sheet. The main technical characteristics of the digital solution have been highlighted in the Excel sheet. Digital solutions have been categorized based on pathology, functionality, and use of support tools. In this phase, digital

solutions were analyzed based on their functionality and digital impact on the regional health system.

#### *Context*

The analysis was conducted for the Calabria region, whose resident population as of 1 January 2021 is equal to 1.860.601 and represents 3,17% of the Italian population on the same date. The over 65s amount to 424.750 and represent 22,6%, while young people represent 12,9% of the resident population.

From a health point of view, the Calabria region has a system that includes five Provincial Health Authority, called “ASP” (Crotone, Cosenza, Catanzaro, Vibo Valentia and Reggio Calabria), and four Hospitals (AO): “Pugliese Ciaccio” Hospital, “Mater Domini” Hospital, Cosenza Hospital, “Bianco-Melacrino-Morelli” Hospital. Each of the five ASPs is in turn divided into districts. The analysis concerned all the previously identified public health organizations.

#### **4. Firsts Results and Discussion**

During the Covid-19 pandemic, healthcare organizations had to limit face-to-face contacts to reduce the risk of contagion, without decreasing the number of healthcare services provided. For this reason, healthcare organizations have implemented ICT tools and digital solutions, to continue to ensure the delivery of healthcare services, including by reducing physical contact. The results highlight the importance and use of digital solutions as a response model to the Covid-19 pandemic.

In this study, we observed the digital solution adopted by hospitals and provincial healthcare companies oper-



ating in the territory of the Calabria region.

Specifically, in the period of time considered by the research, the digital solutions proposed by the Provincial Health Authority of Catanzaro (ASP CZ), Provincial Health Authority of Cosenza (ASP CS), Provincial Health Authority of Crotona (ASP KR), Provincial Health Authority of Reggio Calabria (ASP RC) and Provincial Health Authority of Vibo Valentia (ASP VV) and by the Hospital of Catanzaro (AO CZ) and Hospital of Cosenza (AO CS).

Finally, 26 different digital solutions have been identified, implemented during the Covid-19 pandemic phase, whose distribution is depicted in Fig. 2. ASP CZ appears to be the healthcare organization that has mostly implemented digital solutions during the period considered (48%).

Digital solutions have demonstrated adaptability and flexibility.

Infact, the digital solutions identified have been implemented for different pathologies (Fig. 3).

Some of the pathologies were: Obstetrics, Cardiology, Neurology, Social Assistance and Psychology. Psychology was the pathology that saw most of the implementation of digital solutions (19%).

Healthcare organizations have developed different digital solutions, specific for each pathology.

Digital solutions have been classified according to functions. Four macro categories have been identified: Patient support, monitoring, medical consultation and assistance (Fig. 4).

The assistance service appears to be the most offered during the pandemic period, as is the medical consultation service. This indicates how the

Covid-19 emergency has revolutionized our healthcare system by providing a rapid impetus to experimentation with new technological methods of assistance that have made it possible to control, monitor and advise patients remotely, no longer face to face. In fact, the goal of telemedicine and digital healthcare is precisely to help patients receive health care remotely at “home”, even in critical situations such as the current one of the SarsCov-2 pandemic.

The diversity of pathologies, care pathways and models and types of patients determines different needs, both from a clinical and organizational point of view. This translates into the impossibility of a single solution, but in the presence, within the same company, of several telemedicine solutions implemented with different tools ranging from the sole use of telephone and email, to more structured forms of communication.

In addition, additional contact tools used by digital solutions were identified. Three contact tools have been identified: telephone, e-mail and video call.

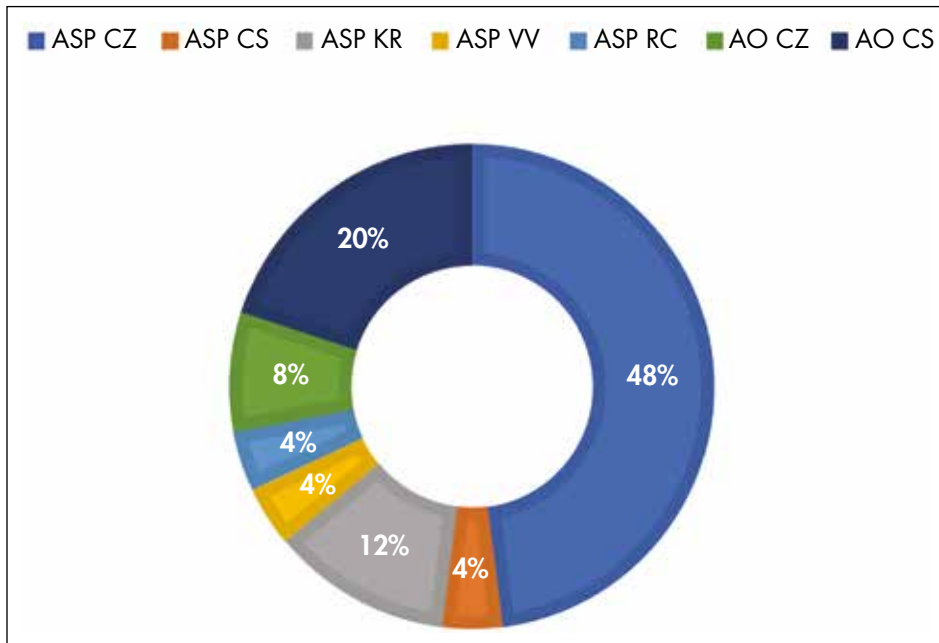
The growth of ICT technologies has had a great impact on the modern healthcare. A fundamental need is to design new electronic health services, digital solutions that can improve people's health and well-being but also extend beyond the individual towards sustainability of the society.

The development of tools for Telemedicine allows both to find new answers to traditional problems of medicine, and to create new opportunities for improving the health service through greater collaboration between the various health professionals involved and patients.

**Fig. 2**

Distribution of digital solutions in healthcare organizations in Calabria

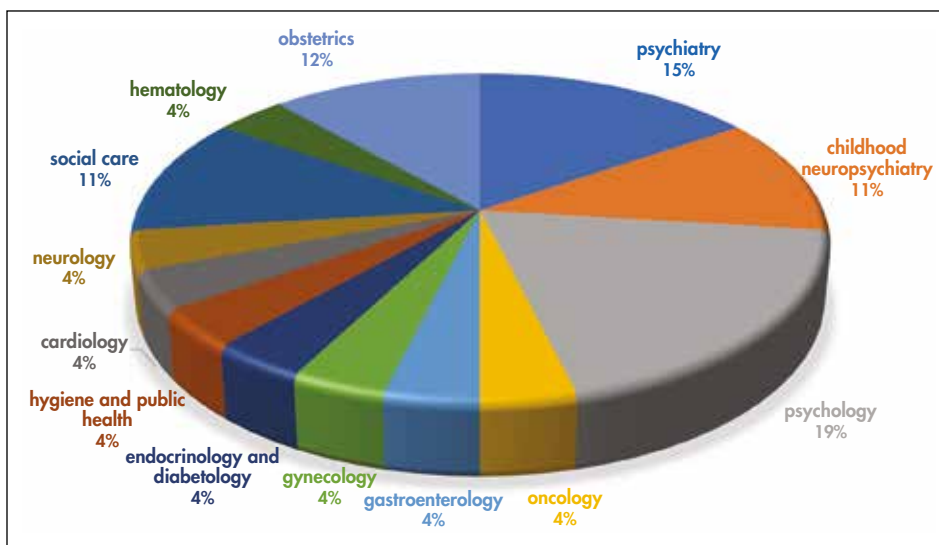
Source: Our elaboration



**Fig. 3**

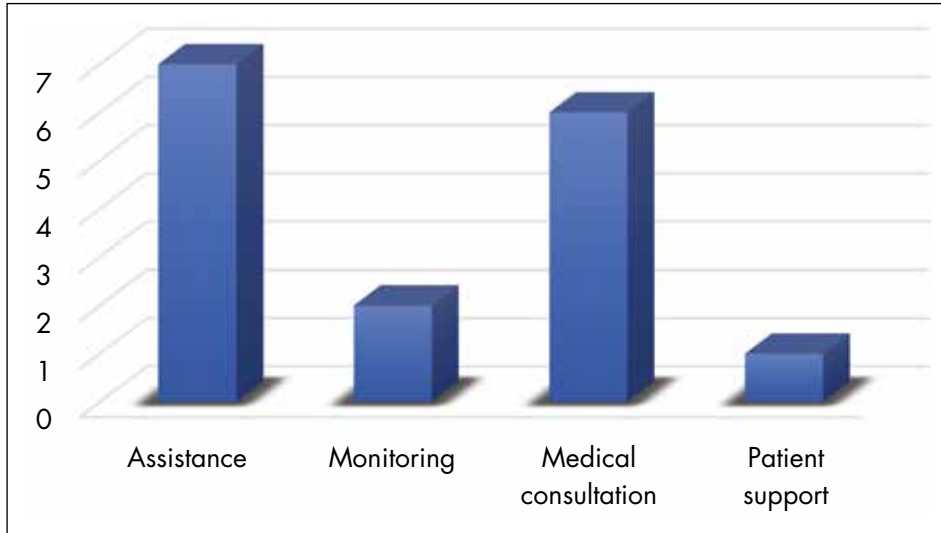
Pathologies

Source: Our elaboration



From the analysis of the results obtained from the mapping of digital solutions activated in the region during the pandemic, it is possible to state how the obstacles encountered by telemedicine can be traced back to the behavioral and socio-cultural perspective of the population. In fact, not

all users have the opportunity to access technologies to use telemedicine services (such as data lines, PCs, Internet), and the knowledge to be able to access these services, especially the elderly population. The above may be the reason why the contact tool most used by patients in Calabria



**Fig. 4**  
 Macro categories for digital solutions  
 Source: Our elaboration

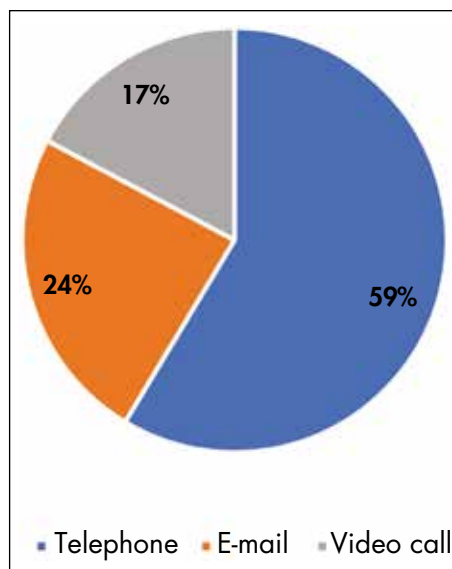
region to interface with health professionals is undoubtedly the telephone (59%). Among the barriers to the development of telemedicine are undoubtedly the resistance and reluctance to adapt to new technologies. In fact, patients may still be distrustful of a new practice. In particular, certain patient categories (e.g. elderly patients) may be reluctant to have an online consultation with a doctor and may prefer to visit a doctor in traditional schemas.

Trust between the patient and the doctor may be compromised in case of a new digital intermediary. Personal communication for most patients is more comfortable than remote treatment.

Patients may negatively perceive virtual meetings as a script for communication with medical personnel. They can feel the loss of control of security and data privacy. Loss of data can be a concern not only during the meetings but also later during the storage period.

### 5. Conclusions

The results of this study highlight the impact that telemedicine, especially in



**Fig. 5**  
 Contact tools used  
 Source: Our elaboration

the Covid-19 pandemic phase, has generated on the Italian health system. In fact, telemedicine should modify healthcare processes giving a real incremental benefit to the patient, improving clinical outcomes, safety and the perceived quality of the patient. In this perspective, the introduction of innovation and new technology in the healthcare sector has a direct impact on

the process of providing healthcare services and on the health of patients.

Furthermore, the use of telemedicine has made it possible to continue to guarantee medical care to patients during the lockdown phases.

To obtain this result it is necessary to overcome the regulatory, technological and reimbursement barriers which, with difficulty, through the publication of circulars, resolutions, framework agreements, are facilitating their implementation at the regional level, but also and above all creating a national basic infrastructure that allows the management of patients' health data and that becomes their repository, fed into the assistance and therapeutic processes enabled by telemedicine.

Healthcare is undoubtedly a sensitive subject. It is highly resistant to change. When it comes to our health, we still want to see a doctor, have physical contact. Telemedicine doesn't replace the doctor visit part, it simply enhances the experience, increases the way you interact with healthcare professionals and allows a more complete spectrum of information to be exchanged, absorbed, analyzed and disseminated. Surely trust will build over time, provided we don't take privacy and security lightly. Telemedicine service providers and health data custodians are required by law to comply with privacy standards or else lose credibility and have their license revoked. To this end, regular audits of business practices and processes will be conducted and annual certificates and licenses will be issued by trusted auditing agencies (Barr *et al.*, 2020).

## 6. Implications and Limitations

The Covid-19 pandemic has been a real test case for emerging digital health concepts and practices.

The study shows how even Calabria with the introduction of digital solutions has facilitated the continuity of the medical service with great potential to protect both patients and healthcare professionals. The closure of hospitals has forced the public to seek out and practice alternative digital health solutions such as smartphones to connect with their doctors and routine follow-up care. Telemedicine has therefore become important during the lockdowns and has enabled the diagnosis, clinical care and follow-up of patients, demonstrating its potential as well as serving marginalized and underprivileged communities.

Undoubtedly, from the mapping of digital solutions carried out in this study, barriers to the development of telemedicine emerge in the period of analysis considered, above all socio-cultural barriers and above all linked to the trust between the patient and the doctor that may be compromised in case of a new digital intermediary. Personal communication for most patients is more comfortable than remote treatment.

The study has limitations, as it is currently a preliminary study, it is in the first phase of the research in which a mapping of digital solutions is presented that can help better understand the impact that telemedicine has on the Calabrian context, trying to highlight any barriers to its implementation. Therefore, in the next steps of the future research, we will try to investigate the barriers to the implementation of telemedicine by interviewing health professionals directly, in order to have a better understanding of the phenomenon under study.

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