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Impacts of Covid-19 on telemedicine in Brazil

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Abstract

COVID-19 pandemic is an extreme global event with significant impacts on society and the economy. Due to its outbreak and the following social distancing, there has been an intensification of the use of telemedicine, with a debate about technology on global and national levels. The aim of this paper is to identify the main impacts of the novel Coronavirus on the short-term use of telemedicine in Brazil. The evidence shows an increasing acceptance of telemedicine lately, considering the number of assisted patients as well, as public and private initiatives. The pandemic tends to accelerate the commitment of society's representatives to the proposition of solutions regarding the key issues that have limited its diffusion in the country. How the interests of public health and private health prevail remains open, considering the perspective that science, technology, and innovation should be subordinated to social needs and specifically to the Unified Health System in accordance with a national strategy of development.

Keywords: Covid-19. Health Economic-Industrial Complex (HEIC). Unified Health System (SUS). Telemedicine. Telemedicine Industry.

Introduction

The so-called modern telemedicine was developed in the last two decades of the twentieth century in the Third Industrial Revolution and should be considered as a modality for the provision of health services when the provider and the patient are in different places, using Information and Communication Technologies (ICT), which range from a simple phone call to technologies that allow video calls or remote diagnosis.

Universal access, equity, quality and costs are the main problems of health systems worldwide, in a reality in which the population is increasingly long-lived and the epidemiological profile focuses on chronic diseases. From this perspective, telemedicine has been seen as a valuable tool to face these problems, and its implementation has been encouraged in several countries.

In addition to the potential beneficial impact on the health dimension, which is reflected in the improvement of human living conditions, overflows in the economic dimension are identified by the multiple capacities induced by telemedicine (Who, 2010).

In the economic dimension, telemedicine has the potential of being a source of innovation, by demanding and incorporating technological advances from other areas and, due to its interdisciplinary nature and its dynamic interrelationships, by the possibility of boosting different industries. In this sense, it constitutes a space in which opportunities for investment, income, and employment are generated, i.e., it is a locus of economic development. In the social dimension, it has the potential of democratizing access to health services, integrating remote regions with health services located in hospitals and reference centers with regard to prevention, diagnosis, and treatment (Gadelha *et al.*, 2012).

The ongoing pandemic has had a strong impact on several socioeconomic activities, especially those that require the movement of people, as in the case of health services. Despite some contrary aspects and restrictions on its use in Brazil, with the emergence of the first cases, the Ministry of Health (MS), with the agreement of the federal councils, specifically that of medicine, enacted temporary measures amending the legislation and regulations in

force to expand the use of telemedicine as an important instrument in combating the new coronavirus.

The analysis of technological, sanitary, economic, political, and institutional interdependence presented in the use and impacts of telemedicine requires overcoming the traditional fragmented and sectoralized views, present in both the economic literature and in public health. Based on the field of political economy and public health, the concept of the Health Economic-Industrial Complex - HEIC (Gadelha, 2003; Gadelha; Temporão, 2018) endogenously associates the economic and social aspects of development, distancing from the approaches that treat the two dimensions in an analytically divided way.

Without policies that guarantee national sovereignty in health production and innovation, the adoption of telemedicine goes hand in hand with the expansion of external restrictions (goods, services, and incomes), creating limits to sustain economic growth, consolidate the Unified Health System (SUS) and universalize access to health.

The trend to adopt telemedicine, accelerated by the context of the Covid-19 pandemic and the technologies associated with the 4.0 revolution, is concrete. Therefore, it requires the improvement of national and territorial articulation, as well as international relations in health and public and private strategies. The analysis of this trend, without any determinism, is fundamental not only to prospect how the future of the health system will be, but also to guide actions and public policies of the present that aim to consolidate SUS and achieve universal access to health in the future.

In this sense, telemedicine needs to be understood in the context of a concept that privileges its insertion to improve access and health care, within the framework of a universal system, overcoming a fragmented, individualized, and exclusionary perspective of health, which has hindered the advancement in terms of concepts and public policies.

This article is aimed at discussing and identifying the main impacts promoted by the coronavirus on medicine in Brazil in the short term, from the theoretical perspective of the Health Economic-Industrial Complex (HEIC), which proposes to guide the production and innovation in health for social needs.

Challenges

The use of telemedicine in Brazil has been the exception, not the rule. Its dissemination in the country faces political, institutional, cultural, ethical, financial, regulatory, technological, and infrastructure challenges, among others.

From a political perspective, there were some initiatives aimed at the development of telemedicine in the country, such as the creation of the National Teaching and Research Network (RNP) in 1989, the Telemedicine University Network (Rute) in 2006 and the National Telehealth Program in 2007, basically led by the Ministry of Health, to which the ministries of Science, Technology and Innovation and Education were added.

However, such initiatives can be considered timid, as they have not been converted into State policies, because they lack a broad interterministerial articulation. For example, the absence of the Ministry of Development, Industry and Foreign Trade (MDIC) and other bodies in the economic area did not promote effective articulations or policies so that the expansion of telemedicine was associated with the development of the national production base, despite some isolated initiatives such as discussions on the subject within the Executive Group of the Health Industrial Complex (Gecis), extinguished in December 2017, or the Inova Saúde Program, an initiative of the National Bank for Economic and Social Development (BNDES) and the Funding Authority for Studies and Projects (FINEP). That is, the national efforts in telemedicine did not have guidelines that allowed us to combine the technological development and the productive base in health with the improvement of access and quality of health services within SUS (Maldonado; Marques; Cruz, 2016). In addition, many regulatory issues remain indefinite, representing a true "dissonance between the immense potential that these technologies present and the prevailing ethical and legal apparatus" (Rezende *et al.*, 2010). It is generally argued that the rules of conduct, standards, and regulations necessary for their application in an ethical and legal manner are insufficient and fragmented in relation to professional services in which the main aspects are privacy, confidentiality, security, informed consent,

responsibility, jurisdiction, competence, technological standards and remuneration for services (ABDI, 2016).

Despite the efforts, especially of the government, to develop Telemedicine, one of the restrictions lies in the concept of telemedicine established by the Federal Council of Medicine (CFM). According to the CFM Resolution n. 1,643/2002, Telemedicine is the exercise of medicine through the use of interactive communication, audiovisual and data methodologies, applied only for the purposes of health care, education and research (CFM, 2002). Due to the current pandemic outbreak, the Ministry of Health authorized the temporary expansion of the use of telemedicine, which will be discussed later.

Despite the need for regulation in the health area to ensure safety, efficacy, and cost-effectiveness of health technologies, regulatory fragmentation, in the case of health equipment, restricts the achievement of the potential of telemedicine, which, depending on the case, must meet the technical regulations of at least two regulatory bodies: National Health Surveillance Agency (Anvisa) and National Telecommunications Agency (Anatel). In addition to the technical requirements, manufacturers, in order to have equipment incorporated into the list of products and services made available by the Unified Health System (SUS) to the population, will naturally have to meet the criteria of efficacy, safety and cost-effectiveness established by law, undergoing an analysis process to be terminated after 180 days. The interoperability of the Electronic Health Record Systems has also to comply with the regulations of the National Health Agency (ANS), CFM and MS (Maldonado; Marques; Cruz, 2016).

Among the main aspects, we highlight the issues related to interoperability, standardization, and security, in order to allow that various products, hardware, and software be integrated into private or public networks, with secure exchanges of digital information in various file formats such as text, videos, photos, audios, etc. The Ministry of Health, with Ordinance n. 2,073 of 2011, defined the standards of interoperability and health information for health information systems within the scope of SUS and for supplementary health. Although this scenario favors a greater use of telemedicine, it should be emphasized that it is not sufficient, since interoperability depends both on the suppliers' compliance with technical

standards and on the dissemination of their culture, which will allow customers to demand this requirement in their evaluation and purchase processes (Silva; Moraes, 2012).

In the remuneration issue, the non-definition of a remuneration model for telemedicine services in Brazil involving SUS, health insurance, medical entities and patients may be one of the reasons for resistance to its effective use (Luz, 2019).

A key issue is the broadband data network infrastructure available to society, and particularly to healthcare providers. The country has a very unequal distribution of broadband connection, well-established in large centers, but more precarious in the countryside, especially in the North and Northeast regions.

Some telemedicine applications require high data transmission rates. For example, tomography or resonance images can reach gigabytes of storage, requiring a high performance data connection to send this data from a health unit to a diagnosis center. To make a simple video call requires a minimum of 8Mbps. In other words, the lack of infrastructure to provide broadband, especially within the countryside, is a crucial factor that hinders telemedicine transmission.

It is also worth noting that part of the healthcare providers and users lack training regarding the use of added information and communication technologies aimed at ensuring comprehensive care to citizens. As an example, one of the main health issues in Brazil, and worldwide, is related to population aging, with the consequent increase in non-communicable diseases (NCDs), for which telemedicine has been considered a useful tool in coping with the high cost associated with its treatment. Recent research suggests a low rate of internet use, approximately 28% in the population over 60 years old (Teleco, 2020).

Therefore, in a country of extremely unequal country such as Brazil, low-income people may have even more difficulty reaching a doctor, either because they do not master the technology or because part of the services currently available can be offered only online. Thus, telemedicine has the potential to increase the gap in access to health among the rich and poor (Islabão, 2020).

On the other hand, telemedicine has the potential of leading to substantial changes in the modus operandi and in the reconfiguration of health services. Telemedicine innovations have a systemic character, that is, they are strongly associated with how services are organized and where they are provided, which can mean changes in the way they work, creating barriers to telemedicine diffusion. The adoption of organizational innovations in services tends to be a much slower process than the incorporation of innovative products since the combination of the adoption of innovative technologies with the redesign of these services generally imposes great challenges to the modus operandi of organizations. Conservative culture, routines, work processes, power structures, professional relationships, uncertainties, risk aversion, among other aspects, generate significant resistance to change. In fact, any conduct that aims to maintain the status quo in the face of pressure to modify it represents one of the main barriers to innovation from an institutional point of view (Clark; Goodwin, 2010).

Similarly, telemedicine faces resistance from the point of view of professionals. For example, it is not an exclusively medical activity, but a cooperation that involves multidisciplinary actors, ranging from a wide variety of healthcare providers and information and communication technologists to managers and policy makers. Therefore, its use implies reformulations of work processes that, in multidisciplinary teams, have greater complexity, as they involve human relations, economic interests that are not always legitimate, resistance of people regarding changes, and it also impacts the power structure.

Another important discussion is the doctor-patient relationship with using telemedicine. One of the fundamentals of medicine is the face-to-face clinical examination, supported by touch and the general evaluation of the patient's condition, which provides a better accuracy of the diagnosis and, above all, the appropriate treatment. The individual relationship between doctor and patient is influenced by several factors, such as the trust resulting from personal contact and prolonged coexistence that stimulates intimacy, the reading of body language, cultural issues such as human warmth involved in this relationship, psychological comfort, etc., questioning whether a screen image can effectively replace personal contact (Luz, 2019), since there is the

potential to include impersonal and non-humanized relationships.

As a result, iatrogenesis is discussed as a factor that compromises quality improvement with the use of telemedicine, as the illnesses caused by the set of professional care are not comprehensively studied by scholars (Illich, 1975). Although the use of resources such as teleconsultation and second formative opinion are examples of improving the qualification of health services in general, increased access may not mean improving the quality in health care. For example, it is argued that, as remote examination is more limited than in-person examination, there is a risk of increasing the number of unnecessary exams without evidence-based clinical indication, which may result in harmful treatments to the patient (Harzheim *et al.*, 2018)

Therefore, the doctor-patient relationship is an extremely sensitive issue to medical practice that is not resolved, being an additional challenge for the use of technological intermediation promoted by telemedicine. In this perspective, Chao (2020) highlights that telemedicine should be understood as an extension and expansion of conventional health services in which much of the procedures and face-to-face care can be complemented or expanded by interactions intermediated by technologies.

It is also worth mentioning the situation of physicians in face of healthcare providers, whether hospitals, health insurance companies or even digital platforms that offer telemedicine services. If, on the one hand, the physician benefits from the propaganda and reputation as a way to ensure they have a number of patients, on the other hand, due to the asymmetry of the negotiating power relations between the parties, there is the possibility of providing services without a formal labor relationship, in flexible on-demand journeys and with low earning for the services provided. One of the major concerns of medical entities is the risk of the category undergoing a process of uberization and flattening of the amounts paid by health providers, although ANS argues that online care is equal to face-to-face care (Schimitt, 2020).

Current Scenario

Despite these challenges, with the current pandemic and the concomitant social isolation with restrictions on mobility, telemedicine has been considered an important instrument in the provision of health services in general and in the fight against Covid-19 in particular, both in Brazil and worldwide. In this sense, through the notice No.1,756 sent to the Ministry of Health on March 19, 2020, the CFM admitted that it was possible to exceptionally provide remote medical care in the fight against the new Coronavirus, in addition to what is established in CFM Resolution n. 1.643/2002, which remains in force. This notice states that telemedicine can be performed in the following modalities: tele-orientation, which allows doctors to remotely guide and refer patients in isolation; telemonitoring, which allows, under medical supervision or guidance, health and/or disease parameters to be monitored remotely; and teleinterconsultation, which allows the exchange of information and opinions exclusively between doctors, for diagnostic or therapeutic assistance (CFM, 2020). Subsequently, through Ordinance n. 467, of March 20, 2020, the MS authorized the provision of telemedicine services not yet regulated, exceptionally during the pandemic, for pre-clinical care, care support, consultation, monitoring and diagnosis, both in SUS and in the private networks, which was also later included in the Federal Law n. 13,989 (Brazil, Mar. 20th 2020; Apr. 16th 2020).

Also in March 2020, the Ministry of Health, within the scope of the strategic action "O Brasil conta comigo – profissionais de saúde" ("Brazil counts on me – health professionals", aimed at expanding and qualifying the workforce to face Covid-19, defined the mandatory registration of these workers for 14 categories of health professionals. They are: social service, biology, biomedicine, physical education, nursing, pharmacy, physiotherapy and occupational therapy, speech therapy, medicine, veterinary medicine, nutrition, dentistry, psychology, and radiology technicians (Brasil, March 31st 2020). The action proposed in the ordinance is valid as long as the state of public health emergency resulting from the current pandemic lasts.

In relation to the various health areas, there is a vast variety in the position

of federal councils regarding the use of telemedicine by professionals and companies providing services. There are councils with totally liberal positions and without any regulation for the provision of online services, such as the federal councils of Physical Education and Social Work; there are others with significant flexibility, such as the federal councils of Psychology and Nursing; while there are some still very reactive, such as the federal councils of Medicine, Physiotherapy, Nutrition and Dentistry.

Chart 1 summarizes the position of the main health professional councils in relation to the use of telemedicine in the provision of healthcare services.

Chart 1 - Position of Federal Councils

Federal Council	Permitted or unregulated services	Prohibited services
Social service	All*	None
Nutrition	Nutritional guidance and monitoring	Nutritional assessment and diagnosis
Dentistry	Teleconsulting, teaching and research	Query
Psychology	Consultations and therapeutic services	Emergency response, violence and rights
Nursing	Fulfillment of prescriptions in urgency, emergency, regulation, Samu, home care and telehealth	Regular fulfillment of medical prescriptions remotely
Physiotherapy and Occupational Therapy	None	Consultation and treatment prescription
Physical education	All*	None

Source: Cruz (2019).

***** Telemedicine services not regulated by the respective federal council.

Online consultation is essential in this time of crisis. With stores closed, population in isolation, overcrowding of hospital units and the prospect that the situation will remain this way for the coming months, there is a potential growth for this type of service in Brazil. In addition, examining and treating patients in person, a paradigm regarding quality medical care, currently represents an elevated risk of contamination for both health providers and patients.

However, regardless of the pandemic, there is an increasing application of telemedicine in Brazil, both by SUS and private health service providers. The country, and SUS in particular, can benefit from this model of health service provision, provided that it is inserted in a broader and humanized view of care, contributing to access in the territorial and socioeconomic conditions in force in Brazil.

Impacts in Brazil

The impacts of the pandemic on telemedicine in Brazil are already noticeable. In recent months, telemedicine programs have become truly relevant in the routine of SUS and in private hospitals, health plan operators and private clinics.

In the field of public health, some important initiatives in the provision of services based on telemedicine stand out. On April 1st, the MS launched TeleSUS, a free pre-clinical remote care service for anyone who has doubts and even wants to have an appointment with a health professional. In addition, the tool allows the Ministry of Health, through active search, to monitor the health of the population, that is, to identify in advance people vulnerable to Covid-19. By June 2020, more than 73 million people have sought TeleSUS services. Of this total, 25 million completed the treatment, without having to leave home, with 1.8 million patients having online appointments with healthcare providers (Casa Civíl, 2020).

It is also noteworthy mentioning the MS Tele-UTI project, available to all hospitals in the country that have beds in Intensive Care Units (ICUs) for patients with Covid-19. The project aims to assist SUS physicians in the care

of coronavirus cases, through the provision of a landline that can be accessed 24 hours or consultations through videoconferences with teams from excellent hospitals. The project is a partnership of the five hospitals of the Institutional Development Support Program of the Unified Health System (ProadiSUS): Hospital Alemão Oswaldo Cruz; HCor; Hospital Israelita Albert Einstein; Hospital Moinhos de Vento and Hospital Sírio-Libanês (Portal Hospitais Brasil, 2020).

We also highlight the Regula Mais Brasil project, carried out collaboratively by the hospitals that are members of ProadiSUS, in which users of Primary Health Care (APS) services that need consultations and monitoring with specialists can be assisted in medical appointments through teleconsultations in the state of Amazonas since July 2020. The objective is, in addition to ensuring access to diagnosis in the public network, to protect patients from being infected with Covid-19, reduce the necessity of going out and the waiting line (Saúde Business, 2020).

To deal with the coronavirus, the RNP has been making efforts to expand the connection of health centers to the internet. In July 2020, it ended the second call to connect about 16 thousand health centers and started the process of hiring suppliers to serve 1.9 thousand Family Health Units in all regions of the country. Currently, Brazil has more than 42 thousand health centers. Access to the worldwide computer network intended in this action is part of the Strategy of Digital Health of the Ministry of Health, which encompasses the digitalization program of the government of Brazil for health, forecasting an integrated use of the electronic medical record of citizens in a large information network (RNP, 2020a)

On an emergency basis, Rute created the Covid-19 Brazil SIG to face the pandemic. SIGS (Special Interest Groups) are groups organized and coordinated by the Rute institutions, in which health professionals discuss specific topics based on videos or web conferences, focused on teaching, research or remote care. The purpose is to bring together tertiary, university, public, and private hospitals, which will treat more serious cases, exchanging experiences between healthcare providers in Brazil and abroad (RNP, 2020b).

The actions of the different state telehealth centers linked to the program called Telessaúde Brasil Redes are focused on structuring and organizing

knowledge and information related to Covid-19, seeking to build qualified support as an action to face the pandemic. Educational initiatives related to the epidemic have been organized, as provided for in some state contingency plans, in addition to extensive production of care protocols, videos, infographics, podcasts, webinars, among other materials (CAETANO *et al*., 2020).

Several state and municipal health departments, from different regions of the country, created official channels using ICTs to enable that the population and healthcare providers have access to reliable and up-to-date information about the disease. Websites where it is possible to find technical notes, educational videos and informative materials for healthcare providers and for awareness campaign, social media; telephone calls, online panels and virtual attendants were also made available (Caetano *et al*., 2020).

Several public health institutions have been offering online services as an important ally in coping with the pandemic by expanding patient care, reducing the risks of contagion and, concomitantly, relieving health services. Examples include the University Hospital of the Federal University of Maranhão, the Cassiano Antonio Moraes University Hospital (Hucam) of the Federal University of Espírito Santo, the Hospital das Clínicas of the Federal University of Minas Gerais, the Institute of Traumatology and Orthopedics (Into), etc.

The Open University of SUS has been offering free online courses on Covid-19 focused on both Primary and Specialized Care based on disease management protocols, essentially aimed at health professionals from all over the national territory (UNA-SUS, 2020).

The Oswaldo Cruz Foundation (Fiocruz), in partnership with the Community Council of Manguinhos, Redes da Maré, Dados do Bem, SAS Brasil and União Rio, launched in August 2020 the project called Conexão Saúde (Health Connection), for comprehensive health care in the favelas of Maré and Manguinhos, in Rio de Janeiro, aiming to contribute to face Covid-19 pandemic. This initiative highlights the potential of telemedicine, when inserted in a broader view of care and access to health. The project includes guidance and support to the local population, telemedicine, molecular testing, contact tracing and development of risk maps within communities (Fiocruz,

2020).

In the field of private health, considering that trends in general are dictated by large companies, Chart 2 shows examples of the provision of telemedicine services by reference hospitals recognized by the Ministry of Health and the ten largest health insurance companies.

Chart 2 - Position of Federal Councils

Company	FU	Service	Audience
Reference hospitals			
Albert Einstein	SP	Nutritional re-education program Smoking cessation Expert opinion Telerehabilitation Tele CPAP	Patients and visitors
		Tele ICU – daily horizontal visit Tele ICU – Urgent and emergency care Teleoncology Teleneurology Tele ICU – Specialized nutritional therapy for critically ill patients	Hospitals and clinics
		Expert opinion Virtual outpatient clinic Smoking cessation Nutritional re-education program	Companies and schools
Sírio Libanês	SP	Teleeducation	SUS
Hospital do Coração	SP	Issuance of reports Teleconsulting	SUS
Oswaldo Cruz	SP	Teleconsultation Telephone guidance from a multidisciplinary team	Patients
Moinhos de Vento	RS	Teleconsultation	Patients

Company	FU	Service	Audience
Private health insurance companies and plan operators			
Amil	Nat	Teleconsultation Chronic patient monitoring	Insured persons
Bradesco Saúde	Nat	Teleconsultation Chronic patient monitoring Health promotion 2nd formative opinion	Insured persons
Cassi - BB	Nat	Teleconsultation Promotion and prevention	Insured persons
HPVIDA	Nat	Teleconsultation Chronic patient monitoring	Insured persons
Sulamérica	Nat	Teleconsultation	Insured persons
National Center Unimed	Nat	Teleconsultation Patient monitoring	Insured persons
Notre Dame Intermedica Saúde PLC	RJ/ SP	Teleconsultation Chronic disease monitoring	Insured persons
Unimed - BH	MG	Teleconsultation Chronic disease monitoring	Insured persons
S. Francisco	Nat	Teleconsultation	Insured persons
Unimed - Rio	RJ	Teleconsultation Chronic disease monitoring	Insured persons

Source: Own preparation based on ANS (2020b) and companies' institutional websites.

Important strategic movements of the main private service providers in the country are observed, in which both hospitals and health companies have been developing initiatives to prevent and manage health, albeit for different motivations.

The hospitals of excellence aim to develop a new market based on preventive medicine and the commercialization of check-up exams, for which, before the pandemic, they had already built structures with multidisciplinary teams and equipment. With the liberalization of teleconsultation, although temporarily, hospitals of excellence increase the scope for attracting new customers, reinforce their strategies to create new packages of integrated preventive health services, as well as reinforce their brand in teleconsultation services to smaller health service providers.

In the scope of supplementary health, insurance companies and health insurance companies also set up structures similar to hospitals of excellence before the pandemic, but for health prevention and management, mainly aimed at reducing costs with chronic patients. With a public note of March 2020, ANS instructed health operators to provide care channels to facilitate remote communication with users regarding the exchange of information for diagnosis, treatment, and prevention of diseases during the pandemic period. As a result, the main operators took the opportunity to advance the offer of on-line services to their customers in a general way, and not only for those with suspicion of contamination with the new coronavirus (ANS, 2020a).

In this scenario, it is worth highlighting the discussion that precedes the temporary liberalization of the use of the teleconsultation service during the pandemic. In 2019, the CFM published resolution No. 2,227, expanding the attributions of telemedicine, enabling remote medical services, vis a vis, teleconsultation (CFM, 2019), prohibited until then by resolution No. 1,643 of 2002. In the face of numerous criticisms from doctors, representative entities of the class and regional councils, especially with regard to insufficient participation in the preparation of this resolution, the CFM opted for postponing its entry into force.

Although this discussion was mainly aimed at teleconsultation, it is reflected in telemedicine in general with regard to the private sector, due to its responsiveness, in the perspective of occupying this market with the offer

of integrated service packages. The anticipated announcement in early February 2019 by the Albert Einstein hospital illustrates this point.

The early launch of packages of services by the private network signals both the game of interests involved and the strong pressures for greater flexibility of regulation. It also shows the tension between the private sphere, concerned with the opening of new markets, and the public sphere, with regard to patient safety, patient information security, doctor-patient relationship, quality or accuracy of diagnosis, among other ethical and legal aspects relevant to the practice of telemedicine. Such aspects reinforce the need for new reflections with broad participation and that contemplate the strengthening of public health in Brazil (Cruz *et al.*, 2020).

With regard to the productive base of telemedicine, it is considered to consist of having only two types of suppliers – medical-hospital equipment suppliers and IT suppliers – and companies that provide telemedicine services.

Within the scope of medical-hospital equipment suppliers, one can include a significant part of companies belonging to the medical-hospital and dental equipment and materials industry. When they transform their analog products into digital ones, input information systems into these products and equip them with data communication interfaces, they are able to act in telemedicine.

IT providers, especially software system developers, whose products and services are purchased by both medical equipment companies and telemedicine companies, in line with the demand for telemedicine services, offer solutions for the provision of teleconsultation services for public health, offices, clinics, hospitals and health insurance plans, as well as for the management of health and preventive health.

The group of companies that provide telemedicine services, composed of national companies and subsidiaries of multinationals, offers, for example, remote reporting services, or telediagnosis, especially ECG and radiology reports, acquiring their equipment from suppliers of this supply chain.

Chart 3 shows some examples of telemedicine companies in Brazil that make up both the group of suppliers – medical-hospital and IT equipment – and those that provide telemedicine services.

Among the companies that supply medical and hospital equipment, seven have local production, presenting a wide variety of products.

Among IT companies that develop software platforms, for example, some have incorporated the provision of services into their portfolio. In other words, companies whose products were originally developed for the Business to Business (B2B) telemedicine market began to operate in the Business to Consumer (B2C) market, as shown by the cases of Bellamaterna's and Bioaps.

Bellamaterna, a startup created as a telehealth platform to monitor pregnant women, for companies and agreements, expanded the hiring of healthcare providers and started to offer services to the general public, aimed at doubling the revenue and increasing the number of employees: from 120 in the beginning of 2020 to 320 employees by the end of the year (Bellamaterna, 2020). Similarly, Bioaps, the developer of a telemedicine solution for patient monitoring focused on prevention, continues to sell its products to companies, but has as its flagship in 2020 the offer of online health services to families (Bioaps, 2020).

Although fragmented, the examples in this industry show a preliminary photography of the main agents that compose it, with the need to deepen a comparative analysis of its evolution, before and after the pandemic. However, previous studies (ABDI, 2016; Cruz, 2019; Cruz; Maldonado; Gadelha, 2020, for example) already signaled a growing interest and expectation of business agents in the growth of demand for products and services in telemedicine.

Chart 1 - Position of Federal Councils

Company	FU	Telemedicine experience
Medical, hospital and dental equipment companies		
Cardios	SP	Digital equipment for map and Holter exams with recorder and system for transmitting exams and reports via the Internet
TEB	SP	Digital equipment for electrocardiography, exercise testing and hemodynamics

Instramed	RS	Multiparametric and vital signs monitors
Bionet	PR	Vital signs monitor and electrocardiograph with integration with various hospital management systems
Icelera	SP	Polysomnography and electroencephalography devices with exam transfer integrated into the software with remote access
Imbramed	RS	Treadmill systems and special equipment for stress testing with data transmission
Lifemed	SP	Lifeview central with capacity to monitor vital signs of up to 32 patients
Meditron	MG	Electroencephalogram and polysomnography equipment with connectivity via USB and TCP/IP
Information technology companies		
Biocam	SP	Solutions for telemonitoring and hospital traceability
Bellamaterna	SP	Solutions for telemonitoring pregnant women
Bioaps	SP	Telemonitoring solutions
Digitro	SC	Defense systems supplier – Interact platform to securely integrate various tools for use in telemedicine (Whats'App, emails, telephone, video calls)
Eco Sistemas	RJ	Solutions for primary care, regulation and hospital management
i9Access	RS	Telemonitoring management system
MV Sistemas	RJ	Hospital management solutions and health plans
Online Clinic	SP	Software for doctors with telemedicine
Sensorweb	SC	Sensors for monitoring hospital and pharmaceutical environments
Telemedicine companies		
Brasil Telemedicina	SP	Remote reports, teleconsultation, telemonitoring, interconsultations

Teleaudo DiagRad	SP	Remote reports in teleradiology
Pixeon Med. Systems	SC	Sistemas de gestão para centros de imagem de hospitais, laboratórios e clínicas
Telecardio	SP	Remote reports in telecardiology – electrocardiogram, Holter, Map and consultation
Teleimagem	SP	Remote reports in teleradiology
Telemedicina da Bahia	BA	Remote reports in telecardiology and teleradiology
Unicare Saúde	SP	Home care and telemonitoring
Mais Laudo	MG	Remote reports in telecardiology and teleradiology

Source: Own preparation based on companies' institutional websites, 2020.

From the point of view of the private sector, market growth prospects, business opportunities, expansion of services provided, potential reduction in the number of services and hospitalizations, cost control, among other factors, there is a potential growing interest of this industry in view of the release of the provision of telemedicine services that are not yet regulated, exceptionally, during the period of pandemic. The pandemic has significantly increased the use of telemedicine, both by SUS and by the private health system, and examples of new services offered and patients served illustrate this point.

The online platform *Doutor Consulta*, launched in March 2020 with 300 doctors, provides online services in the specialties of gynecology and obstetrics, dermatology, cardiology, general practice, and psychology (Dr.Consulta, 2020). In total, since its release, 9,500 consultations have been conducted. At Hospital Moinhos de Vento, in two months, more than 2,000 remote consultations were conducted (Health Sector, 2020).

At the Laboratory of Technological Innovation in Health of the Federal University of Rio Grande do Norte, telemedicine tools enabled more than 40,000 consultations (UFRN, 2020). In São Paulo, the Tele-UTI project, for

example, helps the public health network in cases of severe acute respiratory syndrome due to Covid-19. The initiative works at the Heart Institute (Incor), where a telemedicine center offers consultations with intensivists from ten public hospitals by videoconference. By July 2020, more than 500 health professionals were trained, and 1,500 appointment services were provided (Schimitt, 2020).

A survey conducted by the Associação Paulista de Medicina (APM) in May 2020, with 2,808 professionals from all over the country, pointed out that 48% of respondents have performed remote care during the pandemic. Among these, 32% perform only tele-orientation, 24% perform teleconsultation with patients who they already had and 23.3% offer teleconsultation for new and old patients. Another 9.7% report practicing only telemonitoring, 6.7% provide online appointments with patients suspected or confirmed Covid-19 and 4.3% opt for teleinterconsultation - when there is a doctor on the other end. The number of doctors performing teleconsultation has advanced as the need is established in the face of the pandemic. In April 2020, when the APM conducted the first research on the subject, the rate of remote care for new and old patients was 19.7% and, 2.8% for patients with suspected or confirmed Covid-19. Regarding training, 89.7% of doctors indicated that they did not have any specific training to use telemedicine – a number practically equal to that of April, which was 90% (APM, 2020).

The survey conducted in early 2020 by APM also revealed that, for 43.7% of respondents, the lack of regulation for the use of telemedicine was an important barrier for its use, and 64.4% of the physician's wanted regulation that allowed the expansion of services and appointments to the population, including teleconsultation (Medicina SA, 2020).

Final considerations

Despite telemedicine´s recent growth in the country, it is important to overcome the various challenges pointed out here, so that telemedicine can become a real benefit for society. It is worth mentioning, among others, legal certainty, economic interests, information security, adequate infrastructure,

education and training of health professionals, ethical, and regulatory issues, a better regulated doctor-patient relationship and cultural issues. These are aspects that recurrently appear in articles, studies, and publications on the subject, raised by the advantages of using telemedicine during the ongoing pandemic. The considerable number of initiatives developed in recent months, both by the public entities and by the private sector, indicates that, after the health crisis, there will be a need to advance in the discussion of these restrictions, especially regarding a regulatory standard that allows telemedicine to be inserted effectively and efficiently in the context of humanized care and universal health care.

The health system in Brazil itself faces serious challenges due to the demographic and epidemiological transition that points to increasing health costs, in a current scenario of spending freeze imposed by EC 95 and the serious fiscal and financial crisis of the Brazilian State, aggravated by the socioeconomic impacts of the pandemic. In this context, telemedicine can contribute since it has the potential to address major health problems, such as universal access, equity, quality and costs.

At the same time, the pandemic opened up the fragility of the productive and innovative base of health, in a reality in which the essential products for its combat were restrained by exporting/producing countries. In this scenario, we highlight, for example, the orders for respirators as a matter of urgency made by the Ministry of Health to the national industry. Thus, it is imperative to define and implement systemic public policies and joint and coordinated actions that promote national productive and innovative development, with the articulation of several decision-making bodies and the participation of society, industry, academia, scientific and technological institutions, associations in the health area, class, among other relevant agents in the innovation process. The socio-sanitary dimension and trying to meet the demands and needs of public health must guide the effort of national productive and innovative development.

In the face of the Covid-19 pandemic and the concomitant social isolation with restrictions on mobility, telemedicine is now seen as an important instrument for the provision of health services. As a result, there was a rapid dissemination of its use in the Brazilian health system.

However, it should be noted that the challenges still persist, which requires a broad commitment from society in proposing solutions related to them. Without a clear public orientation to reconcile the technological advancement and the productive base with the specific needs of the population, the risk is the perpetuation of the segmentation and stratification of access to health in Brazil under a new guise. In this process, a broad institutional and societal participation is essential for the development of systemic public actions and policies that allow the use of telemedicine to achieve equitable, integral and universal access to health.

References

ABDI. Associação Brasileira para o Desenvolvimento da Indústria, Centro de Gestão e Estudos Estratégicos Ciência, Tecnologia e Inovação. *Agenda Tecnológica Setorial – ATS. Complexo Industrial da Saúde. Telemedicina Panorama Tecnológico*. Publicado em: 2016. Disponível em: https://docplayer.com.br/46196280-Agenda-tecnologica-setorial-ats-complexo-industrial-da-saude-t-elemedicina-panorama-tecnologico.html. Acesso em: jul. 2020.

ANS. ANS adota medidas para que operadoras priorizem combate à Covid-19. *Agência Nacional de Saúde Suplementar,* 2020a. Disponível em: http://www.ans.gov.br/aans/noticias-ans/co194ronavirus-covid-19/coronavirus-todas-as-noticias/5448-ans-adota-medidas-para-que-operadoras--priorizem-combate-a-covid-19. Acesso em: ago. 2020.

ANS. Dados e indicadores do setor. *Agência Nacional de Saúde Suplementar,* 2020b. Disponível em: http://www.ans.gov.br/perfil-do-setor/dados-e-indicadores-do-setor. Acesso em: ago. 2020.

APM. Associação Paulista de Medicina. *Os médicos e a pandemia do novo coronavírus (Covid-19) – Tecnologias.* Publicado em: maio 2020. Disponível em: http://associacaopaulistamedicina.org.br/files/2020/pesquisa-apm-medicos-covid-19-mai2020-tecnologias.pdf. Acesso em: ago. 2020.

BRASIL. Ministério da Saúde. *Portaria n. 467, de 20 de março de 2020.* Disponível em: http://www.in.gov.br/en/web/dou/-/portaria-n-467-de-20-de-marco-de-2020-249312996. Acesso em: jul. 2020.

BRASIL. Ministério da Saúde. *Portaria n. 639, de 31 de março de 2020*. Disponível em: http://www.in.gov.br/en/web/dou/-/portaria-n-639-de-31-de-marco-de-2020-250847738. Acesso em: jul. 2020.

BRASIL. Lei n. 13.989, de 16 de abril de 2020. *Diário Oficial da União*, Brasília, ed. 73, seção 1, p. 1, 16 abr. 2020.

CAETANO, R. *et al.* Desafios e oportunidades para telessaúde em tempos da pandemia pela Covid-19: uma reflexão sobre os espaços e iniciativas no contexto brasileiro. *Cadernos de Saúde Pública*, v. 36, n. 5, p. 1-16, 2020.

CASA CIVIL. TeleSUS: mais de 73 milhões de brasileiros já utilizaram o serviço que auxilia população no enfrentamento à Covid-19. Publicado em: 22 jun. 2020. Disponível em: https://www.gov.br/casacivil/pt-br/assuntos/noticias/2020/junho/telesus-mais-de-73-milhoes-de-brasileiros-ja-utilizaram-o--servico-que-auxilia-populacao-no-enfrentamento-a-covid-19. Acesso em: ago. 2020.

CFM. Conselho Federal de Medicina. *Resolução CFM n. 1.643/2002*. Disponível em: http://www.portalmedico.org.br/resolucoes/cfm/2002/1643_2002.htm. Acesso em: ago. 2020.

CFM. Conselho Federal de Medicina. *Resolução CFM n. 2.227/2018*. Disponível em: https://portal.cfm.org.br/images/PDF/resolucao222718.pdf. Acesso em: jul. 2020.

CFM. Conselho Federal de Medicina. Telemedicina: CFM reconhece possibilidade de atendimento médico a distância durante o combate à Covid-19. Publicado em: 19 mar. 2020. Disponível em: http://portal.cfm.org.br/index.php?option=com_content&view=article&id=28636:2020-03-19-23-35-42&catid=3. Acesso em: jul. 2020.

CHAO, L. W. *Telemedicina do presente para o ecossistema de saúde conectada 5.0.* São Paulo: Instituto de Estudos de Saúde Suplementar (IESS), 2020. Disponível em: https://edm.org.br/wp-content/uploads/2020/06/Telemedicina_Chao-IESS-23-06-2020.pdf. Acesso em: set. 2020.

CLARK, M.; GOODWIN, N. Sustaining Innovation in Telehealth and Telecare. *WSDAN Briefing Paper*. London: The King's Fund, 2010.

CRUZ, A. *O potencial inovativo da indústria brasileira de telemedicina no subsegmento de telemonitoramento*. 2019. Tese (Doutorado em Saúde Pública) – Escola Nacional de Saúde Pública Sergio Arouca, Fundação Oswaldo Cruz, Rio de Janeiro, 2019.

CRUZ, A; MALDONADO, J.; GADELHA. C. Telemonitoramento e a dinâmica empresarial em saúde – desafios e oportunidades para o SUS. *Revista de Saúde Pública*, v. 54, n. 65, p. 1-11, 2020.

FIOCRUZ. Covid-19: Instituições se unem para projeto inovador em favelas. *Agência Fiocruz*, 19 ago. 2020. Disponível em: https://portal.fiocruz.br/noticia/covid-19-instituicoes-se-unem-para-projeto-inovador-em-favelas. Acesso em: set. 2020.

GADELHA, C. A. G. O complexo industrial da saúde e a necessidade de um enfoque dinâmico na economia da saúde. *Ciência & saúde coletiva*, v. 8, n. 2, p. 521-535, 2003.

GADELHA C. A. G. *et al. A dinâmica do sistema produtivo da saúde:* inovação e complexo econômico-industrial. Rio de Janeiro: Ed. Fiocruz, 2012.

GADELHA, C. A. G.; TEMPORÃO, J. Desenvolvimento, inovação e saúde: a perspectiva teórica e política do Complexo Econômico-Industrial da Saúde. *Ciência & saúde coletiva*, v. 23, n. 6, p. 1891-1902, 2018.

HARZHEIM E. *et al. Guia de avaliação, implantação e monitoramento de programas e serviços em telemedicina e telessaúde*. Rede Brasileira de Avaliação de Tecnologias em Saúde – Rebrats, 2020. Disponível em: https://rebrats.saude.gov.br/images/MenuPrincipal/Guia_Avaliacao_telessaude_telemedicina.pdf. Acesso em: jul. 2020.

ILLICH, I. *A expropriação da saúde – Nemesis da medicina*. Rio de Janeiro: Nova Fronteira, 1975.

ISLABÃO, A. A uberização da telemedicina. *André Islabão*. (Blog). Publicado em: 23 ago. 2020. Disponível em: https://andreislabao.com.br/2020/08/23/a-uberizacao-da-medicina/. Acesso em: set. 2020.

LUZ, P. L. Telemedicina e a relação médico-paciente. *Arquivos Brasileiros de Cardiologia*, v. 113, n. 1, 2019.

MALDONADO, J.; MARQUES, A.; CRUZ, A. Telemedicina: desafios à sua difusão no Brasil. *Cadernos de Saúde Pública*, v. 32, supl. 2, 2016.

MEDICINA SA. Conectividade e saúde digital na vida do médico brasileiro. *Medicina AS*, 12 mar. 2020. Disponível em: https://medicinasa.com.br/pesquisa-globalsummit2020/. Acesso em: ago. 2020.

PORTAL HOSPITAIS BRASIL. Tele-UTI ajudará médicos do SUS nos atendimentos do coronavírus. *Portal Hospitais Brasil,* 15 abr. 2020. Disponível em: https://portalhospitaisbrasil.com.br/tele-uti-ajudara-medicos-do-sus-nos-atendimentos-do-coronavirus/. Acesso em: ago. 2020.

REZENDE E. J. C. *et al.* Ética e telessaúde: reflexões para uma prática segura. *Revista Panamericana de Salud Pública*, n. 28, p. 58-65, 2010.

RNP. Rede Nacional de Ensino e Pesquisa. RNP encerra segunda chamada para a conexão de postos de saúde. *RNP.* (Plataforma online). Publicado em: 30 jul. 2020. Disponível em: https://www.rnp.br/noticias/rnp-encerra-segunda-chamada-para-conexao-de-postos-de-saude. Acesso em: ago. 2020.

RNP. Rede Nacional de Ensino e Pesquisa. Rute cria SIG Covid-19 Brasil e primeira sessão será no dia 23/3. *RNP.* (Plataforma online). Publicado em: 20 mar. 2020b. Disponível em: https://www.rnp.br/noticias/rute-cria-sig-covid-19-brasil-e-primeira-sessao-sera-no-dia-233. Acesso em: ago. 2020.

SAÚDE BUSINESS. Projeto Regula Mais Brasil lança serviço de teleconsultas. *Saúde Business,* 20 ago. 2020. Disponível em: https://saudebusiness.com/mercado/projeto-regula-mais--brasil-lanca-servico-de-teleconsultas/. Acesso em: ago. 2020.

SCHMITT, Gustavo. As questões em torno da telemedicina no Brasil. *Blog Abramge,* 10 jul. 2020. Disponível em: https://blog.abramge.com.br/saude-suplementar/as-questoes-em-torno--da-telemedicina-no-brasil/. Acesso em: ago. 2020.

SCHIMITT, Gustavo. As questões em torno da telemedicina no Brasil. *Panorama Farmacêutico,* 10 jul. 2020. Disponível em: https://panoramafarmaceutico.com.br/2020/07/10/as-questoes-em-torno-da-telemedicina-no-brasil/. Acesso em: set. 2020.

SETOR SAÚDE. A telemedicina na Europa: o que o Brasil tem a aprender? (live Moinhos Talks) Hospital Moinhos de Vento. *Setor Saúde,* 13 jul. 2020. Disponível em: https://setorsaude.com.br/eventos/a-telemedicina-na-europa-o-que-o-brasil-tem-a-aprender-live-moinhos -talks-hospital-moinhos-de-vento/. Acesso em: ago. 2020.

SILVA, A. B.; MORAES, I. H. S. O caso da Rede Universitária de Telemedicina: análise da entrada da telessaúde na agenda política brasileira. *Physis*, n. 22, p. 1211-1235, 2012.

TELECO. Internet no Brasil - Perfil dos Usuários. *Teleco - Inteligência em Telecomunicações*. (Portal eletrônico). Publicado em: 29 maio 2020. Disponível em: https://www.teleco.com.br/internet_usu.asp. Acesso em: set. 2020.

UFRN. Universidade Federal do Rio Grande do Norte. Ferramentas de Telemedicina do LAIS/UFRN possibilitaram mais de 40 mil atendimentos em serviços. *UFRN,* 25 jun. 2020. Disponível em: https://ufrn.br/imprensa/noticias/37196/ferramentas-de-telemedicina-do-lais-ufrn--possibilitaram-mais-de-40-mil-atendimentos-em-servicos. Acesso em: ago. 2020.

UNA-SUS. Universidade Aberta do SUS. Universidade Aberta do SUS oferece cursos online gratuitos sobre a Covid-19. *UNA-SUS.* (Plataforma online). Publicado em: 4 jun. 2020. Disponível em: https://www.unasus.gov.br/noticia/universidade-aberta-do-sus-oferece-cursos-online-gratuitos-sobre-a--covid-19. Acesso em: ago 2020.

WHO. World Health Organization. Telemedicine, Opportunities and Developments in Member States, 2010. Available: http://www.who.int/goe/publications/goe_telemedicine_2010.pdf. Access: July 2020.