

Telemedicine: challenges to dissemination in Brazil

Telemedicina: desafios à sua difusão no Brasil

Telemedicina: retos para su difusión en Brasil

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Abstract

Telemedicine has been seen as an important tool for facing the challenges of universal health systems. The goal of this article is to discuss the main challenges to its full dissemination in Brazil. Being a somewhat new area, there are not many scientific papers that systematize it. This article is an exploratory paper, as it aims to provide an overall perspective on the subject. From an economic point of view, telemedicine is a strategic area due to its intrinsic potential of being a source for generating innovation, for requiring and incorporating technological breakthroughs from other areas, and for its interdisciplinary nature and dynamic inter-relations that drive different industries. From the social perspective, it has the potential to make access to health services democratic, by connecting remote regions with health services located in hospitals and centers of reference for prevention, diagnosis and treatment.

Telemedicine; Public Policies; Sustainable Development; Innovation

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Introduction

Telemedicine, in a broad sense, may be defined as the use of information, and health communication technologies to make possible the provision of healthcare services (expansion of care and coverage), particularly when distance is a critical factor. Access, equitability, quality and cost are the main problems universal healthcare systems face worldwide, in a scenario in which the population is growing older, and health and disease characteristics are changing towards the prevalence of chronic conditions. In this setting, telemedicine is seen as an important tool to face the contemporary challenges of universal healthcare systems.

Most telemedicine services that include diagnosis and clinical management are routinely offered in more developed countries. In addition, biomedical measurement devices, such as heart rate, blood pressure, and blood glucose monitors are more and more used to remotely follow-up and manage patients with acute and chronic conditions. In developing countries, telemedicine has the potential to solve major health challenges, in particular expanding access to specialized health services to regions that do not have them, improving healthcare quality, reducing the length of time between diagnosis and treatment, rationalizing costs, and supporting epidemiological surveillance by aiding in the identification and screening of public health problems ¹.

Despite analysts and scholars placing the emergence of modern telemedicine at the end of the 20th century, in the wake of major developments in information and communication technologies, it is still a somewhat novel activity, not so much due to the temporal issue but particularly for having to overcome technical, legal, ethical, regulatory and cultural challenges, among others, which has limited its process of dissemination. However, over the past few years, extremely favorable conditions to its full development have been created, such as an ageing population, particularly in developed countries, which has expanded the demand for healthcare services. Estimates indicate that in 2050 there will be around 2 billion people worldwide with age 60 and over, meaning that more than 80% of healthcare costs will be related to chronic conditions ². Moreover, the increase in prevalence of chronic diseases, such as chronic obstructive pulmonary disease (COPD), heart failure, high blood pressure, and diabetes, associated to the conditions of modern life and population ageing should be highlighted.

Progressively growing pressures for the control of public and private healthcare expenditures

worldwide, due to a rising demand for healthcare services, are also creating favorable conditions for telemedicine. For instance, in 2012 in the United States, the Centers for Medicare & Medicaid Services established penalties for hospitals, in the form of payment reduction, if patients discharged in less than 30 days after admission were readmitted. Such a measure is seen as a driving force towards the adoption of telemedicine. Other countries, such as the United Kingdom, France and China, are also promoting telemedicine as a means of long-term cost-reduction ³.

Among other aspects that encourage the development of telemedicine, one should mention the perspectives of market growth, particularly in developing countries, basically in regards to health system reshaping and increasing healthcare expenditures; the process of incorporating new technological developments, which means new possibilities in the field of telemedicine in regards to healthcare practices; and the growing acceptance of telemedicine by both practitioners and patients. Worth noting is the fact that, due to behavioral changes, people who are interested only in monitoring their health status without being diagnosed with a particular disease constitute a promising market for telemedicine.

Brazil is a country of unique opportunities for telemedicine development and applications. Its broad territory, with thousands of isolated, difficult-to-access places, the unequal distribution of quality medical resources, among other aspects that put the right to universal, comprehensive and equitable healthcare services at risk, indicate there is huge potential for the expansion of telemedicine in the country. Efforts of the federal and state governments in the implementation of telemedicine support this perspective ⁴.

Therefore, this article aims at identifying, from the main initiatives already in course for the development of telemedicine in Brazil, the main challenges to its full dissemination.

Being a somewhat new area, scientific papers that systematize telemedicine within the framework of public health knowledge and practices are quite scarce. The existing literature mostly addresses the study of national experiences on the different applications of telemedicine. In fact, there is much information and fragmented data, most made available through mass communication media or by international consulting companies of limited access. This is the main limitation of this study.

This article fits the exploratory paper category, as it aims at providing an overview of a given fact about a little known subject ⁵.

In addition to the introduction, this article includes four topics. The first presents the main

definitions used in this area. The second lists the major breakthroughs which have taken place in Brazil for the development of telemedicine, namely government policies, regulatory aspects, business initiatives, and academic capacity. The next discusses the challenges to full dissemination of telemedicine, and the last brings the final considerations.

Definitions

The word “telemedicine” appears in the literature together with “telehealth” and “e-health”, and there is no conceptual consistency among them. Different authors present distinct definitions that vary in terms of comprehensiveness, i.e., its functions, involvement of institutions and practices, settings, and goals to be reached. In general, these concepts relate to the use of communication and health information Technologies, and, oftentimes, are used interchangeably⁶.

For Maheu et al.⁷, for instance, telemedicine is the provision of healthcare services, medical information and distance education by means of telecommunications technologies. Telehealth, according to Marcolino et al.⁸, has a broader, multidisciplinary aspect than telemedicine, as it includes all other health-related areas, such as nursing, dentistry, psychology, physical therapy and speech therapy.

E-health represents the convergence of Internet and health. Thus, it reflects all sorts of health services by way of the Internet, including e-commerce. Apparently, this term was used for the first time by industry leaders and marketing professionals, and may be presented as e-commerce, e-business, e-solutions, among others. However, the term was ultimately incorporated by the academic milieu.

Likewise, there is no agreement in regards to the concept of telemedicine. This is due not to its recent emergence, but because of advances in information and communication technologies. Innovations are opening new possibilities in the field of telemedicine, in regards to professional practice, and the process of conceptualization is as dynamic as the technology development process. New technology applications, features, development and incorporation account for the diversity of telemedicine concepts⁹.

As previously stated, telemedicine is a broadly used term that represents the use of communications and health information technologies to support services, training, and the provision of information to healthcare providers and patients, where distance is a critical factor¹⁰. Thus, telemedicine has the following basic features:

physical distance between the medical services and the patient; the use of technology for the provision of care instead of physical presence; availability of the medical team and health practitioners to provide the service; availability of technology professionals in charge of the development and maintenance of the telemedicine infrastructure; systematization of the telecare process, with the development of medical data protocols; and the structuring of safety, quality and confidentiality of data and services provided through telemedicine¹¹.

According to this perspective, telemedicine is not an exclusively medical activity, but involves synergy between health practitioners and technology professionals for the development of multiprofessional activities that include management and planning, research and development of health education, care and scientific research concepts and solutions, in addition to ethical and legal aspects. Therefore, more than a set of multiprofessional activities, telemedicine is an interdisciplinary area of practice.

Brazil

In Brazil, a number of initiatives related to the development process of telemedicine are taking place. In terms of governmental policies, the Brazil Telehealth Program (Programa Telessaúde Brasil), the National Teaching and Research Network (Rede Nacional de Ensino e Pesquisas – RNP), and the Telemedicine University Network (Rede Universitária de Telemedicine – RUTE) are the most important ones.

The Brazilian Ministry of Health established, in 2007, the National Telehealth Program, focused on primary care, which was expanded in 2011, and named Programa Nacional Telessaúde Brasil Redes. At first, the goal of the Program was to train 2,700 Family Health Strategy (ESF) teams, and contemplated the development of nine core centers in nine Brazilian states, each core center connected to 100 telehealth service units deployed and operating in primary care facilities of selected cities, making a total of 900 service units.

The Program is currently operating in 23 states of Brazil, with 8,097 service units in total serving 3,417 cities¹². Worth noting is the fact that the evolution and the type of service rendered differ from one state to the other. For instance, in the state of Minas Gerais, focus was given to the development of remote electrocardiogram (ECG) testing, due to the significance of cardiovascular diseases in the epidemiological profile of that state. In Rio de Janeiro, TeleRX enables ordinary chest X-rays performed at primary care

facilities to be digitalized and sent to teleconsultants who are experts in Radiology. A significant development in the state of Rio Grande do Sul is the first telediagnostic service for chronic respiratory diseases, highly prevalent in that state, and obstetric sonography with the use of telemedicine. In a mobile unit at the local primary care facility pregnant women can undergo obstetric sonography remotely monitored in real time by specialist physicians. The state of Santa Catarina is developing a broad remote testing transmission network that includes, among others, ECG, CT-scan, ultrasound, and MRI. Tests performed in countryside hospitals have their reports made by medical experts of collaborating centers. São Paulo, in turn, is focusing on tele-education, with initiatives such as the Virtual Man Project, the Young Doctor Project, the Cybermentor Project, the Interactive Classroom of the Future Project, among others.

Another important governmental initiative within the scope of telemedicine was the creation of the National Teaching and Research Network (RNP) by the Ministry of Science, Technology and Innovation (MCTI), in 1989, for the development of national internet network infrastructure for academic purposes. In 2006, RNP launched the Telemedicine University Network (RUTE), to deploy interconnection infrastructure at university hospitals and health teaching units in Brazil. RNP, which has the support of the MCTI, the Brazilian Ministry of Health and the Brazilian Ministry of Education (MEC), is present in the 27 states. RUTE, in turn, has 115 telemedicine and telehealth core centers (Lista de núcleos RUTE. <http://rute.rnp.br>, accessed on 13/Jun/2015).

In the field of information and health-related (IT), back in 2003 the Brazilian Ministry of Health made efforts to design a National Health Information and IT Policy (PNIIS) that culminated, in 2004, with a proposition for a three-party negotiation and the design of action plans. The proposition reflected the deliberations of the 12th National Health Conference, and the Ministry of Health's Pluriennial Plan¹³, but was not regulated and its development was discontinued, to be resumed in 2011. That did not mean that the incorporation of information technology by the health area was interrupted; it continued but without the guidance from a specific national policy, this means, without an explicit, formalized direction¹⁴.

In August 2011, the Ministry of Health's *Ordinance 2,072*¹⁵ redefined the Health Information and IT Committee, and assigned it the task of revising and defining new guidelines, and of sustaining this policy.

Also in 2011, with *Ordinance 2,554*¹⁶, the Brazilian Ministry of Health included in the Requali-

fication Program for Primary Care Facilities (PCF) the IT and Telehealth Brazil Network for Primary Care (Telessaúde Brasil Redes na Atenção Básica) components, for integration with the National Telehealth Brazil Network (Programa Nacional Telessaúde Brasil Redes). The goal of this measure was to provide the PCFs with IT equipment, to connect these facilities with other health-care service units that form the Comprehensive Healthcare Network.

The launching, in 2013, of the Health Innovation Program (Programa Inova Saúde), scheduled to end in 2017 is worth noting. It is a joint initiative of the Brazilian Development Bank (BNDES), the Financing Agency for Studies and Projects (FINEP) and the Ministry of Health, with the purpose of fostering and financing research, development and innovation (RD&I) projects of public and private organizations operating in the Health Economic-Industrial Complex (HEIC). Telemedicine is among the thematic areas in regards to support companies and scientific and technological institutions can receive for the development of new information and communication technologies applied to remote healthcare services¹⁷.

In 2014 the Brazilian Ministry of Health issued Ordinances 2,859 and 2,860. These ordinances encourage the establishment of new state and intermunicipal Telehealth Core Centers, by compensating states and cities for their creation and effective use, measured by indicators that were created for this purpose. By encouraging the use of the Telehealth Program by primary care teams, the Brazilian Ministry of Health makes it the main tool to improve the qualification of primary care services, in particular the qualification of family health teams^{18,19}.

In terms of regulatory action on telemedicine, the targets regarding services rendered and management are privacy, professional practice, and interoperability of information systems. These three dimensions are closely connected, since the information and communication technologies are the ones that provide the necessary tools and infrastructure to ensure the right of patients to privacy and the means for the professional practice of healthcare agents. Regarding the equipment, the regulation basically targets safety and essential performance (efficacy).

Thus, different agents are involved in the regulation of telemedicine in Brazil. For instance, the Brazilian Federal Board of Medicine (CFM), aiming to ensure that the storage, sharing, handling and transference of Electronic Health Records (EHR) are secure, and their authenticity, confidentiality and integrity assured, has issued at least two major regulatory measures in 2002 and 2007.

In 2002, CFM *Resolution 1,638*²⁰ was issued to regulate the medical chart, establishing its minimum content (mandatory information), and ascribed responsibilities for filling out, keeping and handling. In addition, this Resolution imposed the creation of the Chart Revision Committee in healthcare institutions.

In 2007, CFM revoked *Resolution 1,639* of 2002, that established the technical requirements for the medical charts keeping and handling information systems and replaced it by *Resolution 1,821*²¹, in which it approved the technical requirements for digitalization and use of information systems for the keeping and handling of patients charts, in addition to authorizing the elimination of paper and the exchange of identified health information.

The chief ethical aspect elicited by telemedicine is to respect information secrecy, confidentiality and privacy. In Brazil, the practice of medicine is regulated by the Medical Ethics Code (CEM), enacted by the CFM through *Resolution 1,931*²² of 2009. Article 37 and its single paragraph are of particular interest to telemedicine as they forbid the delivery of treatment or other procedures without direct examination of the patient, except in the case of urgency or emergency and proven impossibility of a face-to-face interaction.

Along this same line, CFM *Resolution 1,643* of 2002 limits the use of telemedicine, by defining it as the practice of medicine with the use of communications interactive methodologies, audiovisual means and data, to allow care delivery, education, and health-related research. This definition clearly limits the application potential of telemedicine.

Particularly in regards to patient privacy, article 73 of the Medical Ethics Code prevents the doctor from disclosing information about their patients without their consent. Article 75 forbids the doctor to mention medical cases that may be identifiable, and article 85 prevents the doctor from allowing the handling of medical charts under their responsibility by persons not bound by professional confidentiality²².

The Ministry of Health, in turn, issued *Ordinance 2,073*²³ of 2011, establishing the standards of health interoperability and information for health information systems within the scope of the Brazilian Unified National Health System (SUS), at local, district, state and federal levels, and for private health systems and the supplemental health sector.

The Brazilian Private Health Insurance and Plans Regulatory Agency (ANS) issued a regulatory instrument, *Normative Resolution RN 305*²⁴ of 2012, which established the Standards for Information Exchange within the Supplemental

Health sector (TISS Standard), which applies to healthcare data of private health plan users. This standard has established the requirements for data request and exchange between private healthcare organizations and healthcare service providers. One of the three purposes stated by the ANS in Article 3 is that this standard be applied to the electronic healthcare data records of users of those types of plans.

Particularly in regards to equipment, the regulation established by the Brazilian Health Surveillance Agency (Anvisa) is in more general terms, and does not explicitly differentiate the medical equipment for telemedicine from other medical equipment. Worth noting is the existence of regulatory instruments, including *Resolution RDC 27*²⁵ of 2011, that regulates the procedures of mandatory certification of equipment according to public health surveillance guidelines. Its purpose is to establish the safety and efficacy requirements for this equipment. The second paragraph of this resolution includes the parts and accessories of the medical equipment subjected to the guidelines, but makes no differentiation between direct and indirect use. The *Normative Instruction (IN) 9*²⁶ of 2013, in turn, lists the technical rules to be applied for the compliance certification of the equipment subjected to public health surveillance guidelines.

Moreover, there are conditions under which equipment subjected to public health surveillance guidelines should also meet the requirements established by the Brazilian National Telecommunications Agency (Anatel). Section III of *Resolution 506*²⁷ of 2008, establishes the parameters for the operation of biomedical telemeasurement devices, including the so-called Medical Implant Communication Systems (MICS). In short, this Section establishes the frequency range, the intensity of the electromagnetic field and the conditions for the operation of these devices.

From the point of view of the private sector, market growth perspectives, business opportunities, expansion of the services provided, potential decrease in the number of consultations and admissions, increase in the prevalence of chronic diseases, and cost control, among other factors, explain the rising interest in this emerging industry.

There are a number of domestic entrepreneurial endeavors in this industry in Brazil. They include companies that manufacture equipment for the medical, hospital and dental areas which, by turning their analogical products into digital ones, incorporate information systems with data communication interfaces, thus providing them with telemedicine capability.

It also includes service providers, particularly IT companies, and manufacturers and providers of equipment, such as communication devices, computers (hardware), transmitters and receivers (modems, routers, etc.), whose products and services are procured by medical equipment companies and telemedicine companies. Mention should be made to the software companies, for the development of customized information systems to serve an increasing demand for new and diverse telemedicine applications.

It also includes telemedicine companies, which, in Brazil, are mainly service providers, making remote reports or teleradiology, particularly from ECG and imaging tests, and providing distance education.

There are, also, communications infrastructure-providing companies (coaxial cable networks, telephone and telecommunication systems, satellite systems, radio systems, optic fiber systems, etc.) that make telemedicine possible.

Characteristics of the Brazilian domestic market make the country a pole of attraction for direct foreign investments and other strategies of multinational companies, such as mergers and acquisitions, strategic partnerships and alliances, joint ventures, launching of new products and services, etc., the process of which is to be intensified in the near future. The search for specific competitive advantages by some international players in the Brazilian market, such as Unicare, Cisco, GE Healthcare, Intel, Siemens, among others – in terms of better adjustment of the product to local demand, better quality, lower cost for customers, ability to meet the demands of customers, among other aspects – or even to serve an expanding public and private market, should encourage similar movements by other world competitors, within the framework of mutual oligopolistic interdependence. In this process, it is easy to anticipate the conformation of the domestic economic space to the operational logic and the dynamics of the international telemedicine industry.

As previously stated, Brazil provides significant opportunities for the development and the applications of telemedicine, and the growing domestic and international business interest in this emerging industry points to that perspective. There are clear opportunities for the development of competitive advantages in specific market niches for this original core group of domestic companies.

Within the scope of domestic scientific capability-building, there are about 80 telemedicine-focused research groups registered at the Brazilian National Research Council (CNPq. Diretório de grupos de pesquisa no Brasil. <http://lattes.cnpq.br/web/dgp>, accessed on 08/Jul/2015).

Despite uneven regional distribution, with São Paulo and Rio Grande do Sul leading the domestic rank, this clearly shows that, in spite of being an emerging area, there is growing interest of academic institutions and their research groups in telemedicine.

Worth noting is the fact that only 24 out of the 80 research groups have developed cooperative research projects, most of them with other public academic institutions. Only seven research groups have developed research activities in partnership with the productive sector, with technology-transfer purposes.

Challenges

Despite advances in the development of telemedicine in Brazil, there are challenges to its full dissemination.

From the political point of view, over the past few years the different governmental initiatives concerning telemedicine have been led primarily by the Brazilian Ministry of Health, with support from the Ministry of Science, Technology and Innovation and the MEC. However, these initiatives are not State policies articulated between ministries, with the participation of a number of decision-making bodies. In fact economic decision-making bodies, such as the Ministry of Development, Industry and Foreign Trade (MDIC), are absent and have no say in regards to the implications for the telemedicine domestic production base, even though early discussions about the issue have recently occurred within the scope of the Health Industrial Complex Executive Group (GECIS) or the recent BNDES/Finep initiative, the Health Innovation Program (Programa Inova Saúde).

This means that the national endeavors regarding telemedicine are basically oriented towards the expansion and improvement of health services. However, there are two dimensions in the health area, the economic and the social. The former considers that all health-related products and services be developed from a productive base, public and private, whose activities share a high grade of innovation and are highly dynamic in terms of growth rate and competitiveness. It presents opportunities for investment, income-generation and employment, being, thus, an essential locus for economic development.

The second dimension includes human value and the rights of citizens, being associated to the construction of a status of well-being and the development of national systems for social protection, leading to political and social actions to

allow access of the population to health assets and services, and, at the same time, limiting the economic action of health agents²⁸. In Brazil, the *Federal Constitution* of 1988 includes health as a right of its citizens.

Thus, it can be stated that the action of the State in this field is related to mediation and modulation of tensions and interests between the economic dimension, connected to the process of innovation, accumulation and economic efficiency, and the health and social services dimension related to the interests of the population and equality, from the understanding of health as a right of citizens. The social dimension may leverage the potential for innovation and development of health-related productive activities as it represents a source of demand, financing, priorities of R&D activities, among other systemic conditions of competitiveness that fall favorably upon the performance of public and private health agents²⁹.

Within this perspective, an effective inter-ministerial action would have the merit of promoting the two dimensions previously mentioned: the expansion and improvement of healthcare services and the potential development of an endogenous productive and innovative telemedicine basis.

Mention should be made of cultural aspects as being additional limiting factors to the dissemination of telemedicine, from the point of view of both, institutions and practitioners that must adjust their working processes according to the new technologies being adopted.

From the institutional point of view, a strong correlation between the potential of telemedicine and health services configuration should be highlighted. Telemedicine innovations are systemic in character, which means they are strongly associated to how the services are organized and where they are delivered. On one hand, one can mention the expected gains with the information and communication technologies in terms of swiftness and access, reduction of costs and number of face-to-face consultations which, among other expected advantages, could result from the reconfiguration or changes in health services. This is made possible by this technology that, by combining skills and specialties, may help overcome the obstacle of access posed by the distance³⁰.

However, it is this narrow interdependence between telemedicine and services organization, whose impacts may imply in changes in the *status quo* in guiding the investments, with a shift in the arena of power, that important barriers to the dissemination of new technologies are seen. Likewise, telemedicine faces resistances from

practitioners. As previously stated, telemedicine is not only a medical activity, but a synergy that involves multidisciplinary players, ranging from health practitioners of diverse disciplines to information and communication technical experts to managers and policy makers. The adoption of this technology includes, necessarily, the re-designing of work processes in their multiples aspects, which, in multiprofessional teams, has the potential of generating tensions and conflicts due to the complexity of human relations that are permeated by interests, power and needs.

Moreover, the technologies that make telemedicine possible, in a number of cases, imply changes in the typical doctor-patient relationship, and there should be a process of acceptance, by all, of the technological intermediation. This means, the substitution of face-to-face for virtual contact is an additional challenge to the traditional vision of the practice of medicine and the expectations for health services, for both practitioners and users. Overcoming institutional and professional cultural barriers is an important step in the process of telemedicine dissemination and consolidation.

Therefore, the adoption of organizational innovation by healthcare services tends to be a much slower process than the incorporation of innovative products, since the combination of the new technologies adopted with the re-designing of the services poses, in general, major challenges to the *modus operandi* of the organizations³⁰. Conservative culture, routines, work processes, structures of Power, Professional relationships, uncertainties, risk aversion, among other aspects, generate significant resistance to change. In fact, any conduct aimed at the maintenance of the *status quo* in face of the pressure to modify it is one of the main barriers to innovation from the institutional point of view³¹.

In addition, there is lack of synchronization between the huge potential of these technologies and the prevailing ethical and legal apparatus³². It is argued that, in general, the necessary norms of conduct, standards and regulations for its application in an ethical and legal way are insufficient, and that these technologies may represent a threat for the traditional doctor-patient relationship, and it therefore constitutes an unsafe medical practice. The ethical principles around telemedicine include privacy, confidentiality, safety, informed consent, responsibility, jurisdiction, competence, fee for service, and technological standards. As for the legal aspects, there is extensive jurisprudence in developed countries in which telemedicine is becoming more and more important, and is adopted by health systems³³. In Brazil, the legislation is limited, and the use

of telemedicine ascribes great responsibility to the doctor, and the development of regulations and guidelines for remote healthcare is necessary. As previously mentioned, the CFM limits the use of telemedicine to healthcare, education and research.

The main goals of the regulatory framework in the area relate to the development of an apparatus that addresses the rights of patients, the duties of healthcare providers (institutional or practitioners), and the information systems used. Contrary to the initial attempt of having a set of guidelines with a comprehensive national policy, such as PNIIS, in the forefront, to organize and regulate telemedicine in Brazil, there is a general scenario of fragmentation, characterized by the existence of different laws, decrees, ordinances, norms, instructions, standards, protocols, resolutions and codes issued by different bodies and with distinct focuses. Despite the fact that a single instrument would hardly reach these goals, the fragmentation is one more hurdle to overcome in order to achieve the potential of telemedicine. As an example, one can mention electromedical devices with communication capability, which, depending on the case, must comply with technical regulations of at least two regulatory agencies, Anvisa and Anatel. In addition, if any manufacturer intends to have the equipment they make incorporated into the list of products and services made available to the population by the SUS, such equipment will have to meet the criteria of efficacy, safety, and cost-effectiveness established by law, undergoing a process of assessment whose term for completion is 180 days. In the case of Health Electronic Chart Systems, for instance, this is no different in terms of interoperability, and these systems must comply with regulations established by the ANS, the CFM and the Brazilian Ministry of Health.

From a technical point of view, one should highlight interoperability and standardization as requirements for full dissemination of telemedicine. These conditions imply that all technologies are compatible and follow the same norms to ensure the exchange of digital information (images, texts, video and audio segments) on a national and international level. These standards ensure interoperability among heterogeneous components and allow the development of decentralization-based systems. *Ordinance 2,073* of 2011 by the Brazilian Ministry of Health establishes the standards of health interoperability and information for health information systems used by the SUS and the supplemental health providers. Even though technical regulation of the health information systems highly contributes to its reach, it is not enough, as interoper-

ability also depends on the medical norms, the level of product compliance to the norms, and the interoperability-focused implementation methodology³⁴.

Among other barriers to its effective use, mention should be made of the scarcity of resources and technical expertise, in addition to infrastructure issues. Brazil is a country of extremely unequal regional distribution in regards to broadband availability. In the case of teleradiagnosis, for instance, each radiograph image occupies 6Mb of memory, and a CT scan, 400Kb, requiring enough transmission capacity to enable that, not to mention the connection speed needed for videoconferences³⁵. This means, the infrastructure of the broadband data network is one of the most limiting factors to the expansion of telemedicine in the interior of the country.

Finally, mention should be also made of the precariousness of health services in Brazil, including primary care facilities, outpatient clinics, and even specialized and/or hospital services. Scarce resources, management problems, lack of practitioners, poor compensation, outdated facilities, lack of equipment and consumables, among many other aspects, are recurrently mentioned as the main causes of such precariousness, which is shared by both practitioners and users. It is known that this situation tends to worsen in remote and peripheral areas, and is an extremely important barrier to the dissemination and consolidation of telemedicine in Brazil. Even if the technological infrastructure necessary for telemedicine in Brazil were to be deployed, since this is typically an interdisciplinary activity, the capacity to provide expanded healthcare access would be at risk, despite the availability of technological resources in the country.

Final considerations

Telemedicine has the potential of solving major current health challenges, and Brazil has the necessary characteristics for its full utilization. Its territory is of continental size, a population of 200 million inhabitants, and the mandate to develop a public SUS intended to be universal, comprehensive and equalitarian. In addition to the territorial extension, there are thousands of isolated, difficult-to-access locations where healthcare services are extremely scarce. Brazil also presents an extremely unequal distribution of medical resources and the best telecommunications network in Latin America, among other aspects that indicate the huge potential for the expansion of telemedicine throughout the country. Political initiatives that support and

encourage the use of this technology, a regulatory apparatus in development, a core group of local companies, and scientific capability are the features that complete national advantages for this emerging activity.

From the healthcare perspective, telemedicine is capable of promoting higher integration of the healthcare system, overcoming the still existing and deleterious fragmentation that prevents comprehensive healthcare rights to be effective.

From the economic point of view, telemedicine is a strategic area in regards to its intrinsic power of being an innovation-generation source, for strongly demanding and incorporating technological breakthroughs from other areas, such as information and communication technologies, microelectronics, IT, telecom etc., and because of its interdisciplinary nature and dynamic inter-relations, for its potential to propel different industries, such as medical – hospital and dental equipment and material, service providers, equipment and infrastructure suppliers, among others.

There are, however, challenges that limit its full development. Among these, systemic visions that include health, social and economic aspects, such as the different dimensions of creation and reinforcement of competitive advantages (industrial, technological, foreign trade, human resources, among others), and taking into account the strong interdependence and complementarity of the different activities within the scope of the productive system, rather than a focus on specific activities. Furthermore, telemedicine is

interdisciplinary in nature, this means, its development requires the engagement of different areas of knowledge – medical, information and communication technologies, microelectronics, IT, telecom, equipment, among others –, which reinforces the need for a systemic perspective, and joint and coordinated actions between the different decision-making levels, with the participation of the industry, the academia, scientific and technological institutions, class associations, among other relevant agents in the process of innovation.

From the social point of view, it is also a strategic area within the healthcare system in such a huge country as Brazil. Telemedicine, besides adding efficiency and reducing costs, may expand primary care, meaning the provision of health services to remote areas, as it has the potential to expand the actions of health practitioners, integrating them into healthcare services, including prevention, diagnosis and treatment, delivered in hospitals and reference centers. Thus, the primary characteristic of telemedicine is its ability to make access to health services democratic.

From the social point of view, even though it is a highly important activity, particularly for being more and more mentioned in the literature in regards to the increase of quality and safety in healthcare services delivery and the reforms that are necessary for universal healthcare systems, its sustainability remains limited by poor development of its base of knowledge, as shown by this investigation and the previously mentioned challenges.

Contributors

J. M. S. V. Maldonado participated in the conception, overall coordination, and systematization of the study and writing and critical revision of the content and was responsible for all aspects of the work in guaranteeing its critical accuracy and integrity. A. B. Marques and A. Cruz collaborated in the survey and analysis of the regulatory framework and writing and critical revision of the content.

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Resumo

A telemedicina está sendo vista como uma ferramenta importante para enfrentar os desafios dos sistemas de saúde universais. O objetivo deste artigo foi discutir os principais desafios para a sua plena disseminação no Brasil. Em função do caráter relativamente emergente desta área, existe uma escassez relativa de trabalhos científicos que a sistematizem. Por isso, este artigo se enquadra na categoria de trabalho exploratório, já que tem por objetivo proporcionar uma visão geral sobre o tema. Destaca-se, que do ponto de vista econômico, a telemedicina se constitui em uma área estratégica por seu potencial intrínseco de ser fonte geradora de inovações, por demandar e incorporar avanços tecnológicos oriundos de outras áreas e, em função da sua natureza interdisciplinar e de suas inter-relações dinâmicas, pela possibilidade de impulsionar diferentes indústrias. Do ponto de vista social, tem o potencial de democratizar o acesso aos serviços de saúde, integrando regiões remotas com serviços de saúde localizados em hospitais e centros de referência no que se refere à prevenção, diagnóstico e tratamento.

Telemedicina; Políticas Públicas; Desenvolvimento Sustentável; Inovação

Resumen

La telemedicina está siendo vista como una herramienta importante para enfrentarse a los desafíos de los sistemas de salud universales. El objetivo de este artículo fue discutir los principales desafíos para su plena diseminación en Brasil. En función del carácter relativamente emergente de esta área, existe una escasez relativa de trabajos científicos que la sistematicen. Por ello, este artículo se encasilla en la categoría de trabajo exploratorio, ya que tiene por objetivo proporcionar una visión general sobre el tema. Se señala que, desde el punto de vista económico, la telemedicina constituye un área estratégica por su potencial intrínseco al ser fuente generadora de innovaciones, por demandar e incorporar avances tecnológicos oriundos de otras áreas y, en función de su naturaleza interdisciplinaria y de sus interrelaciones dinámicas, por la posibilidad de impulsar diferentes industrias. Desde el punto de vista social, tiene potencial de democratizar el acceso a los servicios de salud, integrando regiones remotas con servicios de salud localizados en hospitales y centros de referencia, en lo que atañe a la prevención, diagnóstico y tratamiento.

Telemedicina; Políticas Públicas; Desarrollo Sostenible; Innovación

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