English

Telehealth and its global application pre to post COVID-19 pandemic

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Abstract

Introduction: *The article describe the growth of telehealth from 2000 to 2020 taking in consideration the COVID-19 pandemic.* ***Method:*** *a semi-systematic review of the biomedical literature between 2010 and 2020 in accordance with the PRISMA guidelines. Multiple searches were conducted between May and October 2020 using disparate keywords to identify all possible English-language and Spanish-language peer-reviewed literature indexed in PubMed or MEDLINE that was published between January 1, 2010 and October 31, 2020. Original research, reviews, letters, editorials, perspectives, opinions, whitepapers, comments, and study protocols were taking in consideration if they had an important approach.* ***Results:*** *A total of 75 articles were included following the criteria.* ***Discussion:*** *Due to the growth of globalization and the increase of access to internet, it is crucial to incorporate telehealth in the worldwide health system since it involves the use of innovative technologies in synchronic or asynchronous time. Indeed, given the high contagion rate of COVID-19, tele-triage has been the frequently strategy used to monitoring the spread of coronavirus disease.* ***Conclusion:*** *The current world emergency caused by COVID-19 will serve up to impulse the development and rise of use of telehealth. Most countries have innovate in the implementation of telehealth systems but some others -especially in Latin America- such as Venezuela have not, because of its underdeveloped and collapsed current situation. Although telehealth has had many achievements, it must fight to establish itself in society in a post-pandemic world.*

Keywords: *Telehealth; Telemedicine, COVID-19; Coronavirus.*

Resumen

Telesalud y su aplicación global pre y post pandemia del COVID-19.

Introducción: *El artículo describe el crecimiento de la telesalud de 2000 a 2020 teniendo en cuenta la pandemia de COVID-19.* ***Método:*** *revisión semi-sistemática de la literatura biomédica entre 2010 y 2020 de acuerdo con las guías PRISMA. Se realizaron múltiples búsquedas entre mayo y octubre de 2020 utilizando palabras clave dispares para identificar toda la literatura revisada por pares en inglés y en español posible indexada en PubMed o MEDLINE que se publicó entre el 1 de enero de 2010 y el 31 de octubre de 2020. Investigación original, revisiones, cartas, editoriales, perspectivas, opiniones, documentos técnicos, comentarios y protocolos de estudio se estaban tomando en consideración si tenían un enfoque importante.* ***Resultados:*** *Se incluyeron un total de 75 artículos siguiendo los criterios.* ***Discusión:*** *Debido al crecimiento de la globalización y el aumento del acceso a internet, es crucial incorporar la telesalud en el sistema de salud mundial ya que implica el uso de tecnologías innovadoras en tiempo sincrónico o asincrónico. De hecho, dada la alta tasa de contagio de COVID-19, el tele-triaje ha sido la estrategia utilizada con frecuencia para monitorear la propagación de la enfermedad por coronavirus.* ***Conclusión:*** *La actual emergencia mundial provocada por COVID-19 servirá para impulsar el desarrollo y auge del uso de la telesalud. La mayoría de países han innovado en la implementación de sistemas de telesalud, pero algunos otros -especialmente en América Latina- como Venezuela no lo han hecho, debido a su situación actual de subdesarrollo y colapso. Si bien la telesalud ha tenido muchos logros, debe luchar para establecerse en la sociedad en un mundo pospandémico.*

Palabras clave: *Telesalud; Telemedicina, COVID-19; Coronavirus.*

Resumo

Telessaúde e sua aplicação global antes e depois da pandemia COVID-19.

Introdução: *O artigo descreve o crescimento da telessaúde de 2000 a 2020 levando em consideração a pandemia COVID-19.* ***Método:*** *revisão semissistemática da literatura biomédica entre 2010 e 2020 de acordo com as diretrizes do PRISMA. Múltiplas pesquisas foram realizadas entre maio e outubro de 2020 usando palavras-chave díspares para identificar toda a literatura possível revisada por pares em inglês e espanhol indexada no PubMed ou MEDLINE que foi publicada entre 1 de janeiro de 2010 e 31 de outubro de 2020. Pesquisa original, revisões, cartas, editoriais, perspectivas, opiniões, white papers, comentários e protocolos de estudo estavam sendo considerados se tivessem um foco importante.* ***Resultados:*** *Um total de 75 artigos foram incluídos seguindo os critérios.* ***Discussão:*** *Devido ao crescimento da globalização e ao aumento do acesso à Internet, é fundamental incorporar a telessaúde ao sistema mundial de saúde, pois implica o uso de tecnologias inovadoras em tempo síncrono ou assíncrono. Na verdade, dada a alta taxa de contágio de COVID-19, a teletriagem tem sido a estratégia freqüentemente usada para monitorar a disseminação da doença por coronavírus.* ***Conclusão:*** *A atual emergência global causada pelo COVID-19 servirá para impulsionar o desenvolvimento e o boom no uso da telessaúde. A maioria dos países inovou na implementação de sistemas de telessaúde, mas alguns outros - especialmente na América Latina - como a Venezuela não o fizeram, devido à sua atual situação de subdesenvolvimento e colapso. Embora a telessaúde tenha alcançado muitas conquistas, ela deve lutar para se estabelecer na sociedade em um mundo pós-pandêmico.*

Palavras-chave: *Telehealth; Telemedicina, COVID-19; Coronavírus*

INTRODUCTION

Telemedicine is defined by the World Health Organization (WHO) as "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities" [1,2,3,4].

To make a perspective of the COVID-19 pandemic, it has to be specified that first, an emergency is considered as "a sudden and usually unforeseen event that calls for immediate measures to minimize its adverse consequences [5]. But second, there has to be explained that considering some factors there is an emergency grade 3, which is an event that occurs in a single or multiple countries with considerable health consequences, requiring an international response by WHO and other international institutions [(6)].

Even when telemedicine, historically, has been focused on the application of traditional medicine physician to patient and physician to physician and their interactions made by two-way –or more- video and audio communications. The term telemedicine has been used to include training, support services, health information activities and more, which is the reason it's opted to use now the term "telehealth", also to include multidisciplinary healthcare and tele-education. That is to say, the term is not limited only to medicine [(7)].

Telehealth refers to any healthcare process that occurs remotely, including provider training or team meetings, whereas telemedicine specifically describes using technology to connect a patient to a provider[(8,10)]. Telehealth uses innovative technologies: videoconferencing, mobile applications, website monitoring applications, wearable devices and some other to remotely connect health care providers to patients, being synchronic (real time) or asynchronous (commonly by e-mail)[(9,11,12,13)]. On streaming, telemedicine use video conference systems enhance series of peripheral dispositive such as digital stethoscopes, echocardiographs, electrocardiographs, ophthalmoscopes and otoscopes to make a complete medical evaluation of the patient [(14,15)]. The term telehealth includes telemedicine, eHealth, tele-education in health, health engineering used at distance and related terms. Commonly, literacy uses telehealth as an equivalent of telemedicine, interchanging them in the contexts but explaining the same idea.

There is no doubt about the expansion process that telehealth is having in this moment, driving it to a health globalization, having a great and positive impact in the health conditions of some populations. Moreover, most of the terms used to describe telehealth are used in a different way that is the reason why there should be standardization on them to facilitate future bibliographical studies and institutional references[(16)].

METHOD

We conducted a semi-systematic review of the biomedical literature between 2010 and 2020 in accordance with the PRISMA guidelines. Given that our review focuses on a synthesis of multiple mini-reviews performed by the working groups and the heterogeneity of the selected articles, we neither assessed the quality of studies nor aggregated study results, thereby classifying our study as a semi-systematic review instead of a comprehensive systematic review or meta-analysis.

Multiple searches were conducted between May and October 2020 using disparate keywords to identify all possible English-language and Spanish-language peer-reviewed literature indexed in PubMed or MEDLINE that was published between January 1, 2000 and October 31, 2020.

We used a variety of inclusion and exclusion criteria to narrow the lists of candidate articles. To be included and classified into the study, each article had to have: (a) telemedicine or telehealth related topic; (b) application or review in specific topics of medicine; (c) COVID-19 related (just in 2020 studies). Original research, reviews, letters, editorials, perspectives, opinions, whitepapers, comments, and study protocols were taking in consideration if they had an important approach.

RESULTS AND DISCUSSION

From a potential pool of 131 articles, there were excluded 56, so a total of 75 articles were included following the criteria described above.

Telehealth's first reference is an article in 1879 in the Lancet about using the telephone to reduce unnecessary office visits [(15)]. On the other hand, the term "telemedicine" first appeared on 1970s to express "healing at a distance", however, it has evolved to the new and complex ones written above [(1,17)]. Even when it did not appeared before; there was a use of remote care with the use of pedal radios in the 1920s with the "Royal Flying Doctor" service in Australia. Then, the National Aeronautics and Space Administration (NASA) made a step forward to the evolution of telehealth developing innovative ways to provide medical care to astronauts in space and for medical care in commercial airlines during flights [(3,18)]. From 1960 to 2000, telehealth was used mostly to provide healthcare to populations with difficult access, such as rural, prison or remote populations [(7,18,19)].

In the new era, the advance of technologies combined with a high speed internet and the massive use of smartphones make possible to apply the use of telemedicine in the countries [(20–22)]. Nevertheless, only some countries have legally implemented the use of it, like France and Italy[(23)] as an exemple. Over 50% of hospital systems utilized some form of telehealth in 2013 in the United States [24,25] and the legal implementation can vary from state to state, but it has had a great impact in federal and state laws during the last years.

In fact, in the US the Department of Healthand Human Services estimates that approximately 50% of US hospitals use some kind of telehealth and, on the other hand, more than 50% of outpatient encounters in the Kaiser Permanent System (a Private Health System) have been via telehealth since 2015 [26,27], but Kaiser has been an exception to the rule.[26]. All things considered, it seems that the global expansion and growth in telehealth during the last years have been continuous but slower than expected [18,27]. Even though,the impacts of the spread of internet and, the common access to digital devices during the last 2 decades have made an advantage to create better and greater telehealth systems in the near future.

There have been some advances with telehealth in Mexico, where there is a national program in telehealth since 2007, that has its legal bases on the General Law of Health, the Internal Regulations of the Ministry of Health and others [28], other countries in Latin America have made advances in telehealth thanks to the cooperation of/with the Economic Commission for Latin America and the Caribbean (ECLAC), the Pan American Health Organization (PAHO) and WHO, these advances has been increasing but still need to grow and perfect it [3,16,28].

Other illustration can be given by Project Echo, which was developed in 2003 at the University of New Mexico, where uses a hub-to-remote model, where theexpert team at the medical center (hub) uses telehealth by videoconferencing to conduct virtual clinics, peers and students. It has been a model with expansion now operating in more than 30 countries [18,29,30].

Until this moment, telehealth had been primarily focused on conditions for which the physical examination is absent (e.g. teleradiology), less important (e.g., mental health), or principally assessed visually (e.g., dermatology, pathology) [1,3,15,16], but during the COVID-19 pandemic it has been expanding and increasing to other medicine specialties, such as urology, gynecology, otolaryngology, pediatrics and surgery (guided telesurgery) [8,12,18,31–36].

Implementation in Venezuela

Specifically in Venezuela, there was an evolution during the 90's decade, having some advance in software and medical enginery made by the principal universities of the country until what appeared to be 2008 –unknown formal advances during the last decade[37]. Even though, in December 2015, it was officially recognized the term "telemedicine" by the "Law of Telehealth" which admits in its justification that it needed to be published to be the main vital method to make the changes required by the new society [38].

There was a develop in rural and far located places in the Amazonia with the "Maniapure program" that tried to experience in a similar way of telemedicine the practices made in Arizona (ATP) and Bangalore (Narayana Hrudayalaya Hospital). The Maniapure program tried to managed with a low budget, an interesting way of teleconsulting which consisted in a "virtual triage center", were a physician in the far located place fills a clinic history and consult the doubts and a specialist or subspecialist in a central hub can describe and see what is the best way to heal the patient making a contrast with what it has been found and academic literacy, giving an answer in approximately 1-2 hours by the web page they designed, Skype (in case of a live video call) or the best social media they can use at the moment [14,19,20,39]. There are similar cases in Venezuela, but Maniapure program has been the biggest one at the moment.

Another advance that can be considered in Venezuela is the implementation of psychological first aids within the regional emergency numbers (171 or 911 at a national level), but it is just in its beginnings, being a pilot test.

There has to be considered that Venezuela is having a complex humanitarian emergency where there is high emigration, low income, the health system is collapsed, the number of professionals is lower each year and there is also a political crisis that makes any negotiation almost impossible [40].This complex humanitarian emergency is affecting people's access to their basic human rights, including health, economy, safety and security, education, food and nutrition, service provision, sovereignty, freedom of association, among others [41]. To give an explanation, in the 1960s malaria was eliminated in the country and now it has resurged. All these deteriorated conditions in the country have contributed in a negative way to the right development of telehealth.

Telemedicine in emergency situations

COVID-19 pandemic has not been the first time that governments and healthcare providers have used telehealth in response to difficult situations or disasters. The North Atlantic Treaty Alliance (NATO, a military alliance between 29 countries) developed a Multinational Telemedicine System in 2000 which has been deployed during various crises [42].

In Italy and France, there were no formal advances in emergency situacions in telehealth until the second largest burden of COVID-19, when they officially made an open call for telemedicine and monitoring system technologies proposals in March, allowing reimbursements of teleconsultations by their National Health Insurance (NHI), for patients with COVID-19 symptoms, those patients could be known patients or unknown ones. These decrees were made to decrease unnecessary travel for medical consultations, to limit the number of people in waiting rooms and to allow follow-up of confirmed cases from home [23].

In the US, during Harvey and Irma hurricanes, some private telemedicine provided care to relocated victims. In 2003 during the Severe Acute Respiratory Syndrome (SARS) epidemic, China began to explore telehealth and integrated electronic medical systems for possible uses in the future [43]. In Australia, the health department allowed clinicians to provide mental health services via videoconferencing. In 2019, similar services were offered to people affected by the bushfires along the country [44].

On day by day situations, telehealth has been used mostly in rural or remote locations, but especially with COVID-19, given that cities are at a greater risk because of greater population density, there has been a temporary advance in some countries, when there has been funding and creating provisional laws to allow physicians to work from home with patients [8,13,44].The expectation is that some of them may continue in post pandemic time and some may not. One of those is given in the US, where there was made funding to telehealth and implementation of some reimbursement during specifically COVID-19 pandemic [25,45]and, on the other hand, there has been a relaxed policy to deploy telehealth, including interstate licensing, data confidentiality issues and reimbursement [45,46].

One strategy to control the spread of COVID-19 disease has been a "direct triage" or "teletriage" which can classify patients before they come to the hospital or health services physically or, in other cases interconnect patients with the referral hospital [1,7,17,19,47–49]

This COVID-19 pandemic and some other emergency events can help to develop telehealth, given that it's a scenario when infrastructure remains intact and clinicians are more available to see patients than during normal times. To make a contrast, countries and programs who have invested in telehealth systems have made a step forward to guarantee life by no exposition cases to the virus than those who have not [50].

In some countries, facial recognition companies have adopted thermal facial recognition to identify persons with high temperature at screening checkpoints or thermal recognition made by drones to identify possibly individuals at risk.[7] This COVID-19 pandemic has brought an advance in the use of telehealth, increasing the number of laws to create, regulate, fund and improve systems of telehealth in different countries such as Colombia, United States, France, Italy, Venezuela and others [23,44,45,51].

Barriers

Underdeveloped countries have mentioned that telemedicine could have a high cost, taking in consideration the poor infrastructure and the low technical expertise in the field [21,22,39,52,53]. Some of these countries consider that there is a legal barrier that implicates individual privacy, security and a possible low demand to develop it ([16],[54]).

The speed at what the ordinary medical consults are going to change to telemedicine is quickly as the speed COVID-19 pandemic is increasing in the world. This transition has made difficult to physicians and patients to anticipate the barriers they have or the ones they probably will have to implement telemedicine visits with success.

It is important to add that one of these barriers is access to digital communication. To give an illustration, in the United States, 81% of adults own a smartphone and 73% own home broadband [55]. That is to say, exists a grand "digital divide" that represents the virtual inequity or inequality related to socioeconomic status, race/ethnicity, sex, age, or geography [17,27,56,57].

Most countries lack a regulatory framework such as authorizing, integrating, and reimbursing telemedicine in their health care, especially in emergency situations [23]. For instance, in the US, 26 states in 2018 had a policy that needed an informed consent policy for telemedicine and/or 9 required a special telemedicine licensure for physicians [58,59].Even though, during COVID-19 pandemic payments for telemedicine services are equal to in person ones on Medicare and Medicaid [17,60,61]. The majority of medical insurance does not cover telemedicine treatment and does not provide reimbursement for patients [2,36,62].Considering that, an appropriate remuneration is needed for all telehealth services, but funding and reimbursement are some of the most discussed items when talking about telehealth. For instance, in Australia, funding is mainly concentrated in videoconferencing consultations for rural and remote places.

Commonly, there are two possibilities available for patients: (1) telemedicine with private providers mostly with high costs or private insurance payment and (2) free telemedicine, with common used platforms such as WhatsApp, Skype or Facetime [15,48,59,62], but they usually do not respect national health data privacy and security requirements. Although, they are useful and alleviating to the national healthcare systems, they are usually unintegrated within these healthcare systems, not sharing data for epidemiological surveillance [22,23,62].

Another barrier considered is the willingness of clinicians, given that the acceptance of telehealth first relies on if they perceive telehealth as normal, effective and safe [62]. On the other hand, there is limited training on telehealth curricula, which make some physicians not expert enough to use these platforms [63,64].

Taking a deep look into Venezuela's case, the main barrier is the lack of access to internet and/or electricity. Considering that electricity is intermittent in most of its states and that the access to the internet is given to only to 60% of the country [65], but 51% of them has intermittent internet during the day according to national media.

Advantages

The socio-economical changes during the last decades have achieved better quality of life, taking a special focus on better alimentation, hygienic conditions, health politics and health systems. These changes have become in a great opportunity to create, develop and upgrade telehealth systems [3,21,22,52,54,67].

The use of high-speed internet, the upcoming technological improvements and the mass spread of smartphones, combined with the comfortability of having a teleconsultation from patient's home and a physician hub or home, leads a more sustainable model of care than the current one. Given

that telehealth has been usually focused in rural or remote areas, it can be applied in metropolitan regions because they have significantly the same demands as remote areas [19,22,23,39,46].

One of the main advantages that telehealth has is its cost benefits, taking in consideration decreased time in travel, decreased staff nonproductive time, and increased efficiency of appointments. Allowing remote delivery of services to those who are immobile, cannot drive, live in rural areas, or cannot travel for other reasons. These virtual visits lead to a time-savings for both providers and patients [4,17,27,61,67,68].

The simulation on the instruction of health practices has contributed to education in under and post graduate programs [69].There are various forms to implement simulations; it can be through the use of basic or robotized mannequins, clinical cases, discussion medical tests and others.

Other advantages that could be seen in the near future could be the unification of data banks to assistance the State, hospitals and health providers on making epidemiological profiles, following of chronical diseases and assisting on health services programs [16,20–22].

In that way, telehealth facilitates equity in the access to assistance services independently of its geographical localization; reducing waiting time on consultation, diagnosis and treatment, avoiding derivate problems and also avoiding overload on health services [3,7,48,62,70,71], making telehealth the best way to reduce inequity in health access [20,21,53,57]. Providing care, convenience, comfort, confidentiality and, during pandemic time, also has helped reducing contagion [17,72–74].

Tele-education

Health education has been transformed into a tele-education model due to the difficulties and continuous risks of having a normal education during the COVID-19 pandemic, giving a “new beginning” and a revolution to keep and to evolve tele-education and telehealth in the future. Medical learners have been able to receive lessons, lectures and webinars from local and world experts on topics of their interests often for free. Tele-education specifically on telehealth fields has renewed the importance on observation based exam.

On the other hand, these advances have led to quickly transform learners into possible professionals dedicated to telehealth, given that most of them have grown with technology [18,57]. In addition, the base of collaborative learning that tele-education is having, have led to global collaborations on the care of COVID-19 by experts around the world at a click of distance, helping to reimagine medical education beyond this pandemic [18,69].

Some other ideas has been made by health students during the COVID-19 pandemic, such as virtual surgical skills workshops, virtual mentorship programs, virtual meetings to discuss projects, brainstorm to have new ideas of transforming normal education into tele-education [34,35,69].E-Learning in medical education is just in its beginnings, but it has a promising future. On a similar way, there has to be education for clinicians, providers and patients to learn how to work with telehealth [49,50,59,60,75].

CONCLUSIONS

Telehealth and telemedicine are terms with relatively new use, but for the purpose of future investigations there should be unified criteria, consequently just one of them is used correctly. Health care organizations around the globe have made an incredibly effort to develop a correct model of telehealth system, but in Latin America specifically in the public sector even when there is effort about it, it can be considered that it is not ready to adopt it and mix it with their national healthcare systems.

The COVID-19 pandemic has made possible to achieve different goals in the adoption of telehealth, making regulations, laws and initiatives possible. However, these little but great advances have to be continued in the future, given that telehealth is here to stay, then, it still has many work to do to be a real solution to inequity.

Especially during this pandemic time, the main advantages of the use of telehealth has been the teletriage and video-consultation, to avoid the overload of hospitals and also to prevent new contagious by exposing them into hospitals.

Venezuela, as many countries, have made advances in telehealth, however, there is a lot of work to do in the country to fix the health care system. Even though, telehealth can help in the near future in the contribution of develop a better health care system if authorities are willing to do it.

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