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Telemedicine: Developments and Challenges of E-Health

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Abstract

Telemedicine as an opportunity for the development of e-health in the prevention and recovery of the population's health, demands a national investment for remote care from digital work, thus offering the patient access to close care where medical knowledge can be available any place where it is needed. Objective: To socialize the results of scientific studies in telemedicine available in the last 3 years, with emphasis on international experiences. Methodology: Narrative literature review using significant studies that were collected from Scopus, Science Direct, and Scielo databases. Due to the volume of telemedicine articles, articles published between 2020 and 2023 were included in the analysis, they were analyzed through thematic content analysis. Results: The results showed telemedicine has a positive impact on the use of healthcare resources in most countries. Conclusion: telemedicine will have a significant impact on the biopsychosocial care of society, reflecting the history in the context of the COVID-19 pandemic, being a key answer in the healthcare system, during that period as a preventive measure.

Keywords: *Telemedicine, Healthcare, accessibility, prevention, resource utilization*

1. Introduction

Medical care has been applied to telemedicine shows a relevant global coverage for all patients, as there are more and more needs to develop a simple and fluid communication between doctors and patients, who demand that internet services allow greater fluidity in video communication or platforms for obtaining data.

From the 1970s, telemedicine became an elementary component in the use of digitalization in health services, however, telemedicine is still an emerging topic that deserves extensive research (Albahri et

al., 2018); different studies agree that telemedicine allows to reduce the travel or displacement of patients and staff, as pointed out by Biswas et al. (2020) that despite some limitations, telemedicine with audiovisual installation is inclined to be an effective way to provide even end-of-life care (EOLC) to patients with advanced cancer.

Likewise, the use of ICT in the health sector in electronically delivered healthcare services, known as e-Health or e-Health, have begun in recent years to change medical work in transformative ways, as the momentum of technologies modernizes the delivery of health care. This transformation also requires the collaboration and joint commitment of citizens, academics, civil society, companies and the government itself; digital transformation is a progressive process, whose results improve public services (Huamán and Medina, 2022). In both public and private institutions, e-Health projects entail challenges for procedures, interoperability, standardization, integrity and security. It is essential to learn from others; In this way, the skills of how to choose the right technology or what methods to use are acquired. However, as all new experiences involve failures, including that there are diverse experiences depending on the environment, context and economy of the countries, national health systems demand that countries make decisions and commit (WHO, 2021).

Especially important for patients who cannot travel to medical centers due to terminal illness, strict restrictions on movement, the authors' experiences evidenced the ability to manage physical symptoms and major psychosocial needs. In the study by Zachrison et al. (2019), of 977 US emergency departments found that 46% did not use telemedicine, considering cost as the commonly cited reason for lack of adoption, concluding that cost is a commonly reported barrier that may be limiting the scope of telemedicine adoption. Within a health context, Al-Samarraie et al. (2020) found that advances in the use of telemedicine were insufficient and varied across countries in the Middle East. Some cultural, financial, organizational, individual, technological, legal components. For example, physician and patient resistance, poor infrastructure, lack of funding, poor system quality, and lack of information technology training were associated with low adoption of telemedicine in the region, preventing it from being regulated for the use of telemedicine.

At the national level, digital health policies have an adverse effect on health care crises, policies, are intended to curb the spread of diseases, there is still a limited level of personnel, infrastructure, technical equipment and logistics to facilitate good care to patients. With insufficient public investment in health of only S/2200 million per year, the infrastructure gap in health of more than S/27 billion in five years is far from being closed. Even despite the significant improvements of recent decades, the gap of 6 health professionals per 10,000 inhabitants still needs to be closed, in order to have the necessary professionals in person, including doctors (Rodríguez, 2021), moreover, there is a restricted number of units that have technology. Telemedicine is hereby investigated as a development opportunity and challenges of an e-health,

The following question arises: What scientific studies on telemedicine have been available in the last three years?

In addition, the following objective is proposed: Socialize the results of scientific studies in telemedicine available in the last 3 years, with emphasis on international experiences. And the specific objectives are: To inform the results of scientific studies on the demand for telemedicine training available in the last 3 years. Report the results of scientific studies on telemedicine technologies available in the last 3 years. Report the results of scientific studies according to the telemedicine specialties available in the last 3 years. Report the results of scientific studies on ethical aspects of telemedicine available in the last 3 years.

The study is justified given the use of telemedicine service resources, by the scope that can be achieved in the future, for different needs of patients from different demographic, cultural, social and economic contexts. Likewise, given the sudden appearance of Covid-19, the passive initial situation of telemedicine became more relevant, requiring elements that help face and minimize the transmission of the virus, becoming a means of defense for both patients and doctors. However, the practice of these services remains unresolved and needs adequate regulation, addressing major ethical and legal issues of telemedicine practice (Solimini et al., 2021).

It is urgent, the accessibility of medical services, the connection that provides different benefits in terms of communication via the internet; In addition, the study of the use of telemedicine as a mitigator of the impact on health and the use of health resources is justified, it can allow and mitigate the advance of possible epidemics, providing support in health systems, especially in the areas of public health, prevention and clinical practices, as well as carried out in other sectors such as telework and education (Vidal-Alaball, 2020).

Another important aspect is the overwhelming health system to which medical professionals must adapt to the use of new technologies, so telemedicine becomes a viable response to care problems, since it goes beyond a simple connection with patients, often dying in a remote place, rather, it assists in shared decision-making, enables care planning, guides potential caregivers in managing symptoms, and provides psychological support to family members (Biswas et al., 2020). It is methodologically justified given that the present review study represents a powerful source of information for professionals looking for cutting-edge evidence to guide their studies (Lau and Kuziemsky, 2016), it is also a study that provides interdisciplinary information from public management, technologies, humanities and medicine, so the study provides different research results in different areas. Publicizing the experience of medical researchers in patient care through telemedicine where portable devices such as the Smartphone must often be used for the service delivery process.

Theoretical framework

Telemedicine is a medical practice, which allows coordination between different individuals and facilitates their collaborative efforts in the diagnosis or treatment of a disease through information technologies and telecommunications; therefore, this domain needs multidisciplinary advances, particularly in the use of telecommunications, informatics and instrumentation for the exchange and management of medical data (Albahri et al., 2018). Similar findings were found by Zobair et al (2019) in their study conducted in rural public hospitals in Bangladesh regarding patients' expectations regarding the adoption and institutionalization of telemedicine and favorable policy guidelines. Likewise, Alenoghena et al, (2023) reviews several proposed telecommunications technologies together with the standards and challenges of advances in telemedicine technology and protocols, concluding that in the face of the important challenges and possible future directions regarding telemedicine technology, the choice and use of any type depends on the availability of the infrastructure, Type of application and costs.

While the Korean experience provides development lessons from the policy-making Ministry of Information and Communications aimed at establishing high-speed information networks to connect households, government agencies, educational and research institutes, private companies, and health centers, the complete model is little or no replicable since it is based on the particularities of each country. With Korea ranked by the UN as one of the top five countries in the world for 20 years, being at the forefront of e-government development is proven to be due to political economy analysis that identifies different drivers that collectively contribute to success (Turner et al., 2022). In this regard, the possibility of introducing telemedicine services depends on the economic situation and the study of political reality. Suzuki et al. (2020) suggest that in South Africa there are possibilities to implement telemedicine services, in the same way the possibility of implementation is high in Thailand, since internet transmission is improving; However, based on the results, the study finds it necessary to first understand the economic situation of the region and then implement the introduction plan. It should be noted that the similar study by Alsulamea et al. (2016) refers to eHealth as all forms of eHealth delivered using ICT while allowing patients and health professionals to access and manage data in ways that were previously impossible.

Social cognitive theory is an essential theory of individual behavior; this theory explains behavioral decision making; it supports the present study, since the adoption of social cognitive knowledge is linked to behavior as a product of the interaction of individual factors and environmental factors, to offer a look at the understanding of individual behavioral intentions. Individual factors reflect internal factors: knowledge, experiences, attitudes, and psychological states. While environmental factors are external factors that correspond to the interaction between an individual and the environment; self-efficacy and confidence are two relevant concepts of this theory (Wu et al., 2021). The development of this theory explains the expectations of health professionals and patients about the adoption of

telemedicine in public hospitals, as an impact on society and on the expectations of telemedicine users, laying the groundwork for greater policy intervention (Zobair et al., 2019). In addition, ICTs in the area of health generated changes leading to the development of theoretical models that promote the understanding and use of new technologies, with different approaches depending on the contexts and countries. (Guiñez-Cabrera and Mansilla-Obando, 2022).

Telemedicine

The American Telemedicine Association defines telemedicine as the use of medical information exchanged from one site to another through electronic communication to improve a patient's clinical health status (Suzuki et al., 2020). Telemedicine, while not a panacea for all the challenges facing modern health systems, has a substantial impact and ever-expanding potential to revolutionize the ways people receive health care while offering the ability to contain costs, manage chronic diseases, and prevent secondary complications. By demanding innovative solutions and speaking in support of the field, the telemedicine community can and should lead the charge for greater attention to human factors in technology development, interoperable medical records, staff training and competencies, standards and guidelines, and support to expand coverage at the national, state, and local levels (Brennan et al., 2008). Telemedicine is a proven modality to provide palliative care to the most vulnerable people (Calton et al., 2020), represents a reality in current health care and is considered strategic by WHO, since it improves the provision of health services in areas with less access to health resources (Moreno et al., 2018).

E-health

Electronic health (eHealth) is the delivery of health care using modern electronic information and communication technologies, even when health care providers and patients are not present. E-health is defined as the set of technologies applied with the help of the Internet, to provide health care services in improving the quality of life, facilitating the provision of medical care (da Fonseca et al., 2021). Likewise, e-Health is the use of information and communication technologies for health support and for the various fields related to health (WHO, 2021). The Faculty of Health Sciences of the Universitat Oberta de Catalunya in Spain, carries out training and research activities in the field of telemedicine since 2008. In collaboration with (PAHO)/WHO, many have focused on Latin America with the common goal of promoting digital health worldwide (Saigí-Rubió, 2023).

2. Materials And Methods

To achieve the objectives, the findings of scientific articles published in recent years were synthesized. For the development of the literature review with a qualitative approach, information sources or databases such as Scopus, Science Direct and Scielo were delimited. Due to the volume of telemedicine articles, articles published in the last three years were included in the analysis. Those that were analyzed through a methodology of thematic content analysis to focus on examining the topic, also the technique used in the collection was the exploratory analysis technique for the collection of relevant information (Escudero, 2020), on the experiences that were achieved worldwide in terms of telemedicine whose selection and review was strictly of research existing in scientific digital repositories, 30 important studies that were collected according to objectives and keywords with a predominance in articles in English. The inclusion criterion was the choice of articles whose information was the experience on the clinical and technological efficacy of telemedicine; while the exclusion criterion was the articles of previous years of 2019, in addition books or theses were not included. There were no restrictions on any illness or medical discipline.

3. Results and Discussion

A The review provides scope for telemedicine in terms of how telemedicine can become equally or more effective with traditional care (Angelopoulou et al., 2022); however, the different experiences found highlighted that the requirement to continue in medical work during the COVID pandemic made it clinically possible to implement actions with telemedicine. The findings of this review support the view that, in the right context, telemedicine will not compromise the efficacy of clinical care compared to conventional forms of health service delivery (Snoswell, 2021). The rigorous synthesis of the knowledge collected from the articles is shown in the following tables where the main contributions that distinguish each type of selected study that can be used by academics and

researchers of telemedicine are described, the present review allowed to report the results through four categories, corresponding to each specific objective.

Table 1: *Results of the review of articles on the category in demand of telemedicine training*

Author and year	Language	Type of study	Contribution
Calton et al. (2020)	English	Descriptive analysis	Preparation, patience and practice will help ensure the effective implementation of telemedicine. Additional support and innovation are essential as they can help remove barriers.
Nittari et al. (2022)	English	Narrative review	A number of barriers need to be overcome for the telemedicine system to function properly and effectively in all countries. For telemedicine to be sustainable and beneficial beyond pandemics, several technical, educational, infrastructure, legal and economic aspects must be resolved.
Obeidat & El-Salem (2021)	English	Op-ed	Small telemedicine efforts have been feasible in the Kingdom of Jordan, but a large-scale national program is needed. Coronavirus infection rates and deaths in Jordan call for designing and implementing a national telemedicine program.
Officer et al. (2023)	English	Interpretive description	Successful implementation requires ensuring a strong relationship between patients and physicians. To safeguard minimum standards in telehealth-based care delivery. Ensure that appointments should be clearly articulated and documented for each person.
Araújo et al. (2021)	English	Qualitative study	It highlights the experience of health professionals, public policies and training, to improve the understanding of digital health, considering the exponential growth in the use of ICT in care, teaching and research environments. It reinforces the need to promote the updating of health professionals.
Accorsi et al. (2022)	English	Descriptive quantity	Even in life-threatening situations, untrained general practitioners can be properly guided by telemedicine specialists to perform point-of-care multiorgan ultrasounds to improve bedside diagnostic assessment.
Figueroa et al. (2020)	Spanish	Op-ed	It is the responsibility of health professionals to adapt and plan innovative strategies and change existing paradigms (9,12) in the face of new challenges that patients may pose as a result of their updated access to information.

Table 1 shows the result regarding the specific objective of the scientific studies on the demand for telemedicine training available in the last 3 years; the importance of research that agrees on the importance of training is highlighted, in this regard Al-Samarraie et al. (2020) argued that the lack of training in information technology is associated with the low adoption of telemedicine, avoiding the regularization of its use.

Table 2 *Main results of the review of articles on the category telemedicine technologies*

Author and year	Language	Type of study	Contribution
Alenoghena et al. (2023)	English	Mixed review and non-experimental	The development of telemedicine systems is discussed with a particular focus on the various communication technologies employed: remote communication with telemedical servers, wireless communication deployed in telemedicine.
Al-Samarraie et al. (2020)	English	Systematic review	Progress in the use of telemedicine was insufficient and varies across countries. Regulatory challenges were encountered: poor system quality and lack of technology training. It proposes recommendations towards the integration of innovative technologies.
Biswas et al. (2020)	English	Case studies	Experiences of three patients with advanced malignancies in the provision of CLLD during COVID19 confinement are shared. Well planned. The study of the usefulness of this service for a larger population of cancer patients from different sociocultural and

			demographic backgrounds in the future is justified
Elhadi et al. (2021)	English	Cross-sectional quantitative	The study reveals high levels of usability and willingness to use telemedicine as an alternative. However, internet connectivity and electricity issues could be a major barrier.
Vidal-Alaball et al. (2020)	English	Op-ed	There are simple, available technologies such as phone calls that have made continuity of care and doctor-patient communication possible during these pandemics.
Doniec et al. (2023)	English	Op-ed	Local scientific conferences focused on telemedicine research can be a catalyst for changes in attitudes and regulations and the development of recommendations for the practice of telemedicine and e-health.
Alonso (2021)	English	Op-ed	Telemedicine has become a critical technology for delivering healthcare to patients. The article presents a systematic review of the implementation of telemedicine and e-health systems during COVID-19
Meireles and Schaefer (2023)	English	Exploratory data collection	Telemedicine must first worry about solving the nodes that hinder access to telematic and health services. This is the only way to affirm its true vocation: to be an instrument to promote social justice.

In accordance with the specific objective in terms of scientific studies that address the importance of telemedicine technologies available in the last 3 years, table 2 shows the experiences regarding the promotion of technologies as a transformation that requires the collaboration and commitment of citizens, academics, civil society, companies and the government itself; that contribute to the progressive process, whose results improve public services (Huamán and Medina, 2022).

Table 3 *Main results of the review of articles on the category telemedicine specialties*

Author and year	Language	Type of study	Contribution
Choi et al. (2022)	English	Quanti Tativo retrospec	Telemedicine experiences in laryngoscopy procedures explain the need for more imaging, procedures, voice therapy and referral to other specialists.
Madaan et al. (2021)	English	Transversal quatitativo	Teleneurology based approach to the management of spasms. The fundamental principles of managing infantile spasms, decentralization of patient care are included.
Murugesu et al. (2020)	English	Systematic review	Telemedicine has a role to play in improving clinical efficacy and education in gynecology. Its applications have proven to be safe and effective.
Suzuki et al. (2020).	English	Quantitative descriptive	Sample made up of doctors, nurses and midwives, concluding that it is necessary to incorporate future medical needs as indicators to make a more appropriate assessment.
Nieblas et al. (2022)	English	Systematic review	It provides a systematic mapping study of the different domain areas and methodological advances in Telemedicine. A 70% positive emotional valence score was found.
Camacho (2023)	Spanish	Comparative analysis	The act of telemedicine: towards a new concept of medical-personal assistance
Freire et al. (2023)	English	Systematic review	It reveals tensions caused by the forces at work in health micropolitics. Despite significant barriers, telemedicine contributed to the care of chronic patients during the COVID-19 pandemic
Monraz-Pérez et al. (2021)	Spanish	Op-ed	A telemedicine service is a huge challenge, it requires the participation of: human resources, infrastructure, updating and permanent innovation. At the expense of human rights legislation.

Pinacho et al. (2021)	Spanish	Op-ed	Pediatricians can make use of this tool and the experience is reported internationally. Proper training and adherence to the basic principles of good medical practice.
Abad-González et al. (2022)	Spanish	Quantitative Delphi methodology	It provides recommendations on issues, needs and requirements for a quality telematic consultation to patients with nutritional pathology.
Domingues et al. (2020)	English	Review of indexed articles	It presents studies in areas of Neurology. It provides described contributions of telemedicine in the diagnosis and treatment of neurological conditions.
Llanes-Castillo (2023)	Spanish	Quantitative, non-experimental	Design of an instrument in line with theoretical advances and relevant in future research. It evaluates the perception, knowledge and attitudes of physicians regarding the use of telemedicine.

Table 3 shows the main studies, with respect to the specific objective in correspondence to the specialties of telemedicine, it is observed that there are spatialities of greater interest related to telemedicine such as neurologists, dermatologists, pediatrics gynecologists, however, some specialties such as anesthesiologists and surgeons show less interest. Similarly, this domain needs multidisciplinary advances, particularly in the use of telecommunications, informatics and instrumentation for the exchange and management of medical data (Albahri et al., 2018). Similar findings were found by Zobair et al (2019) who observed that in rural public hospitals in Bangladesh regarding the adoption and institutionalization of telemedicine and patient-friendly policy guidelines.

Table 4 Main results of the review of articles on the category ethical aspects of telemedicine

Author and year	Language	Type of study	Contribution
Crossbowmen (2023)	Spanish	Literature review	It aims to go beyond the health consultation that provides a service to the patient. It seeks to be a collaborative and formative consultation for the professional who requests it, facilitating direct interaction with the referring specialists. Fundamental ethical aspects have been taken into account for its proper implementation.
Oliveira & Oliveira (2021)	Spanish	Op-ed	The use of telemedicine in primary care presents different ethical and bioethical aspects that need to be analyzed. In addition, it lacks its own legislation and standards that guarantee the rights of patients and value the doctor-patient relationship,
Echeverría et al. (2021)	Spanish	Data analysis	It reflects on the meaning and ethics of the use of Telemedicine, both in its general dimension for the use and distribution of knowledge. The need to carry out an adequate evaluation of each instance is highlighted, both from the point of view of the patient and the professional. The need to legislate on the matter arises
Wu et al. (2021)	English	Quantitative, non-experimental descriptive	Novel in its application of social cognitive theory to the study of telemedicine; It expands knowledge in this area by considering the particularities of telemedicine services and exploring how motivated people have a strong desire to achieve their goals and, in turn, will harbor positive psychological emotions.
Saigí-Rubió (2023)	Spanish	Op-ed	It describes the Center's contribution to the work of the Pan American Health Organization (PAHO) and WHO in supporting countries in Latin America and Europe to develop new telemedicine services and guidance on how to address COVID-19 through digital health solutions. Future actions are also highlighted.

Table 4 identifies the result regarding the specific objective on the scientific studies regarding the ethical aspects of telemedicine available in the last 3 years; As in any profession, physicians involved in telemedicine have an ethical responsibility. Solimini et al. (2021) argued that ethical and legal issues related to the practice of telemedicine services still need specific rules of application in order to ensure equitable access, quality of care, patient privacy, data protection and confidentiality, and the author noted that telemedicine services could currently only be used as complementary tools.

Finally, it should be noted that the results were obtained from a total of 32 recent articles of the last three years, these articles were found in the database of Scopus, Science Direct and Scielo. Figure 1 illustrates by bars, the thematic classification obtained in the search for articles, these findings agree with the specific objectives whose categories and number of articles are as shown:

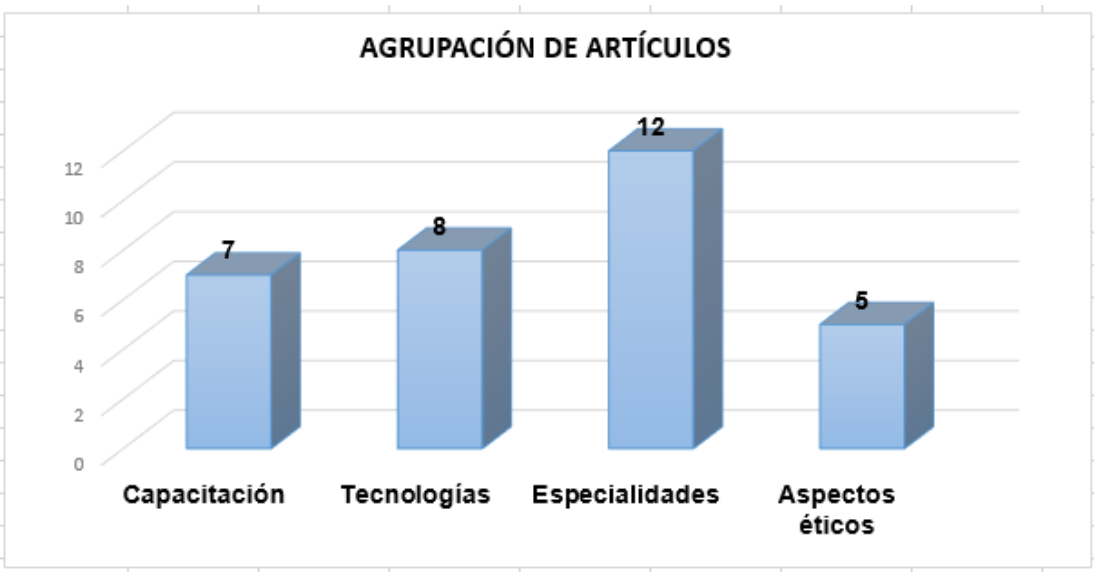

Figure 1 Thematic classification obtained in the search of the articles

Figure 1 shows the thematic classification of telemedicine, where it is observed that 7 articles were found for the training category; 8 items for the category technologies; 12 articles for the category specialties and 5 articles for the category ethical aspects

4. Conclusion

The selected literature on scientific studies in telemedicine available in the last 3 years highlighted relevant aspects that should be taken into account in the application of telemedicine; it is essential to learn from others, so the study showed international research where telemedicine has the potential to have a significant impact on both the biopsychosocial care of society, where health professionals play a fundamental role, as they did in the context of the COVID-19 pandemic, with telemedicine being a key response in the health system.

Training in telemedicine is fundamental, preparation in the handling of electrical components that allow continuity, take advantage of the potential of medical services, mastery over technologies, important aspects to ensure that patients receive the best possible care. Results of studies in telemedicine technologies agree that, with the advent of advanced technology, there is a greater interest in the use of telemedicine by health professionals and patients. Telemedicine technology integrates communications, medical equipment and other terminal devices in service of the patient.

There are telemedicine specialties of greater interest than others; The use of telemedicine varies between different clinical contexts, in addition to the educational and economic level of the patient population, in addition to the health policies provided by the country. The ethical aspects of

telemedicine should be widely addressed, given the complexity of telemedicine according to the reviewed literature, the ethical aspects of the practice of telemedicine services need greater regulation, so as not to jeopardize the principle of protection of patients' private information.

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