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An Analysis of Telemedicine Experiences and Services in Chile

Antonio Rienzo Renato

Abstract

Applications based on telemedicine have been progressively increasing, and Chile is not the exception. After a set of isolated projects and government programs, a National Telehealth Program has been defined in the country. The content of this chapter intends to make a contribution to know the current situation of the country in this area. The author explains the main reasons why there is inequity, and geographic and demographic conditions that drive the need for this type of telemedical applications to grant and improve the health care of the population are explained. The chapter includes a brief theoretical conceptual summary with the characteristics, advantages, and disadvantages that telemedicine incorporates. Also, he presents the results of some of his investigations. Finally, the foundations and lines of action of the new Telehealth program that has been launched in the country are presented.

Keywords: telemedicine, Telehealth, e-health, telemedicine services, home care, information and communication technologies (ICTs)

1. Introduction

One of the major problems defined by the World Health Organization (WHO) in patient satisfaction is precisely not being satisfied with the system. Long waiting times to find a solution to their pathologies and long waiting lists to be able to perform exams or surgery are the problems that bare the lack of implementation and lack of specialists within the public service. In addition, if we add the evolution of the population toward an aging population as projected by the United Nations, where according to data from the 2017 revision of the report "Perspectives of World Population," it is expected that the number of people over 60 or more years (13% of the world population) will double by 2050 and triple by 2100; it will go from 962 million in 2017 to 2100 million in 2050 and 3100 million in 2100, reaching 22% [1, 2]. This population is more prone to chronic and degenerative diseases, which entail a wide demand for beds and days of hospitalization in the public service, which obviously makes the situation of overpopulation of patients in hospitals worse; attacking these diseases in a preventative manner, with monitoring systems, and country level strategies of care and prevention would be ideal to reduce the cases of chronic patients, assuming the aging of the population, but at the same time taking it with full responsibility in the field of public health.

On the other hand, in the context of Chile, we have a country with a unique topography, between the Andes mountain range on one side and the Pacific Ocean

on the other, with a width of only 177 km from east to west and 5152 km from north to south, where the population is poorly distributed with an average country density of 20.4 Hab/km^2, but with some cities having more than 400 Hab/km^2, we have a collapsed system [3]. Therefore, doctors and specialists are concentrated in cities with higher densities, thus, causing a great social and economic cost for patients from more isolated sectors who must go to the major centers of reference to receive medical care. This is why the country is in an unbeatable position to allocate resources and be a leader in applications that help to decongest hospitals, decrease waiting lists, and grant access to the inhabitants of more isolated areas in our country. Telemedicine is considered as a solution to this type of problem. This is how the country's Ministry of Health (MINSAL) has decided to support telemedicine applications developed in different areas over the last few years, improving care in different pathologies [4]. Applications such as teleophthalmology, teledermatology and telecardiology are part of the portfolio of services being delivered in the public sector today to improve access and care for patients. But what is the true scope of these applications? This research can be a source of information and input for any institutions or health facilities that want to carry out intervention programs in its population with telemedicine programs.

The author of this Chapter, is an electronic engineer (Pontificia Universidad Católica de Valparaíso), with a Master's degree in Computer Engineering (Universidad Técnica Federico Santa María), and another Master's degree in Management of Health Organizations (Universidad de Valparaíso), he estimates that as an academic and researcher at the University of Valparaíso, it was necessary to generate knowledge and experiences, to know and spread the real state of telemedicine in the country. In this chapter, he appeals to his work experience acquired in the area of telemedicine, as Chief of Information Technology of a Public Health Service, and summarizes a sequence of background information resulting from his own work, projects, and research.

2. Theoretical framework

First of all, we mention that Telehealth aims to improve access and opportunity to health services, and it must be developed under the model of integrated health services networks (IHSN), defined by the Pan American Health Organization (PAHO) as "a network of organizations that provides, or arranges the provision of fair and integral health services to a defined population, and is willing to be accountable for its clinical and economic results" [5].

The Telehealth presents us with an innovative strategy that allows us to optimize specialized human resources, complementing actions and solutions that allow the benefited population to experience a substantial improvement in access to health care. This being a strategy includes the access gaps to the system and the opportunity for attention to the patients.

2.1 Telemedicine

Among the different definitions used for the term telemedicine, we can agree for its most frequent use, that is, a way of providing health services to patients who are limited to it by geography, work, or health issues. In these cases, telemedicine can improve the accessibility and efficiency of these services. In the same sense, the WHO refers to telemedicine as "the provision of health care services in cases where distance is a critical factor, carried out by health professionals who use information and communication technologies (ICTs) for the exchange of valid information to

make diagnoses, prevention and treatment of diseases, ongoing training of health care professionals, as well as for research and evaluation activities, in order to improve the health of people and their communities" [4, 6].

There is a great variety of medical specialties and technological applications in telemedicine although there is no standardized categorization for the latter; they can be classified according to their applications, specialties, method of data transmission, and according to the geographical area. Regarding definitions and terminologies, it is considered necessary to standardize the following terms, from the extensive portfolio of medical specialties, which have gradually been converted into telemedicine applications. The following are some of the most representative and highly used specialties in our country [4, 7].

A. Telecardiology: Consists of the prevention, diagnosis, and treatment of cardio-vascular diseases, especially acute myocardial infarction (AMI) at a distance. It allows the interaction of primary health care personnel (PHC) in real or deferred time and on an ambulatory basis with cardiologists to avoid geographical movement and to solve emergencies. Initially, it consisted in the interaction between the health staff and the specialist doctor (through electrocardiograms); at present, the equipment can record and send electrocardiograms, echocardiograms, heart sounds, sounds, and images.

B. Teledermatology: Consists in the exchange of medical information (through visual communication, or transmission of photographs or images). It allows the PHC staff to interact in real or deferred time and on an ambulatory basis with dermatologists to avoid geographical movement and grant diagnosis at a distance. Since diagnostics are mainly in images (storage/sending/receiving), it makes the consultation and subsequent response an effective way to grant consultation of diagnoses, treatments, and health care management.

C. Teleophthalmology: Consists of the referral of the patient, where health personnel interact with the patient and a specialist doctor, about a problem related to eye injuries. It allows deeper exploration and detection of other lesions or altera-tions, such as the screening of diabetic retinopathy.

D. Telepsychiatry: Consist of the referral between the patient and the specialist doctor, at the different levels of pathologies, such as depression, anxiety, stress, schizophrenia, use of substances, etc.; through videoconferencing interventions in adults, children and adolescents, and mental health programs.

E. Telenephrology: Consists of the referral between a family doctor in the deferent center, and a nephrologist (online or deferred, with or without the patient), about the history of a patient with chronic kidney disease, and his/her possible treatment and evolution.

F. Teleneurology: Consists of the referral and provision of neurological assistance between the patient and the specialist doctor; when they are not present in the same place and/or temporary moment (through videoconference, images or data of the clinical history).

G. Other Teleconsultations: Consists of the consultation or referral, between the patient, the health personnel, and a specialist doctor (in a remote location), in real time or deferred, about diagnoses, treatments, medical images, or requirements, in a certain pathology (not included in the others named before).

H. Teleradiology: Transmission of radiological images from one place to another for the purpose of diagnosis, interpretation or consultation. To be able to make teleradiology, a digital X-ray equipment, or a conventional X-ray machine plus a digitizer are usually required. In this case, a remote service is already provided. The interaction happens here between the X-ray technician and the doctor.

Also, within telemedicine, two basic modes of operation can be distinguished: (a) in real time or synchronous mode, (b) in deferred time or asynchronous mode, or, as it is also known, the storage-sending mode [4, 8, 9].

For the synchronous modality, it is required to schedule an appointment and simultaneous availability of the agents that will interact in the session; it is based on the interaction in real time and live, which allows live communication from the treating doctor or another professional, patient, and specialist, the latter being who will deliver diagnostic and/or therapeutic guidelines to the treating doctor. We have to distinguish two types of synchronous modality: programmed (making an appointment) and urgency (when the patient needs to talk to the doctor at that same moment).

The asynchronous modality allows the storage and transfer of data and fixed images (store and forward) in "deferred," which are sent to a specialist professional along with the patient's medical history, so the doctor issues a diagnostic and therapeutic advice. In this modality, there is no direct interaction between the specialist and the patient, and the asynchronous mode is used in those cases in which the diagnosis or consultation of the information sent does not imply an emergency situation, and its query can be deferred in minutes and hours, using, for example, the mail as a means of transmitting the information. This modality is the one that has greater volume of activity at the present time.

Telemedicine is characterized because distance exists between the sender and the receiver (doctor-patient), so it is necessary to use some means of communication to transmit the necessary information, and that at both ends, there are some means or equipment that codifies the shared information. It is also essential to have the necessary infrastructure to establish a telecommunication (teleconsultation). For this, there are indispensable elements that are used for the use of telemedicine. Among the minimum components that a telemedicine network must contain to ensure adequate medical support from a distance, we can mention [10]:

- patients;

- health personnel in primary care (PHC) or first contact (general doctor, nurse);

- the consulting center (fixed or mobile);

- medical specialists or subspecialists;

- reference centers or telediagnosis (second or third hospital level);

- an adequate telecommunication network;

- the necessary equipment (video conferencing equipment, medical peripherals); and

- company and/or technical support staff.

2.2 Latin American experiences

According to the World Health Organization (WHO) [10], telemedicine is defined as "the provision of health care services, in which distance is a critical factor, by professionals who appeal to the technologies of the information and communication in order to exchange data to make diagnoses, recommend treatments, and prevent diseases and injuries, as well as for ongoing training of health care professionals and in research and evaluation activities, in order to improve health of the people and communities in which they live."

One of the first activities carried out from the academic point of view was to investigate and learn about telemedicine experiences in the countries of Latin America. To this end, certain sources of information were used, and it could be established that although some of these publications had been published in Santiago, Chile, none of them mentioned a case of Chilean experience [11].

According to the specialized literature on the subject (only in Latin America), there are countries such as Costa Rica, Brazil, El Salvador, Ecuador, Mexico, Colombia, and Panama, where the Government has defined and established a "telemedicine policy," with precise guidelines regarding objectives, prioritization of projects, processes, and concrete actions with allocation of resources [6, 11–13].

2.3 Advantages and disadvantages

As mentioned above, ICTs offer great potential to solve the challenges faced by developed and developing countries in providing accessible, timely, and quality medical services. Telemedicine uses ICTs to overcome geographical barriers and increase access to health care services. This benefits rural areas and marginalized communities that do not have direct access to specific health care.

Telemedicine is one of the most prominent, known and used branches of Telehealth, according to the American Telemedicine Association (ATA). Telemedicine is the exchange of medical information between two actors that are not located in the same space, which can be doctor/patient, or doctor/doctor; through electronic communications, through some means of electronic communication, in order to improve the health status of a patient. It includes "a growing variety of applications and services that use videoconferencing, email, smartphones, wireless communications and other forms of telecommunications technology" [4].

The specialized literature on the subject mentions that there are several advantages and benefits that different telemedicine applications can bring [9, 10].

2.3.1 Advantages

One of the most relevant advantages of Telemedicine is the reduction of inequalities in the population to have access to health services, regardless of geographical location. It also facilitates equity in access to such services by providing high quality universal medical care.

It also provides patients with specialized medical care, in places where they do not have it (or it is very time consuming), reducing the need for travel by patients and/or health professionals.

It allows the reduction of times and waiting lists; by means of a shorter time in the realization of the diagnosis and consequently, less time in the treatment, avoiding delays in the serious cases that could cause problems for the patient.

It manages to increase the efficiency of the system by optimizing health care resources, improving demand management, reducing hospital stays, and reducing repetitions of examinations as well as medical acts.

It also allows the decentralization of demand in medical care, avoiding the saturation of emergency services, as well as in second and third level hospital units.

You can also specify benefits by groups of beneficiaries:

1. For patients: Diagnoses and faster and more timely treatments; reduction in the number of further and multiple examinations; comprehensive and continuous care from the first moment; the discomfort of displacements for patients and relatives is avoided, to consult a specialist doctor, reducing possible expenses. It also facilitates the intradomiciliary management of the disabled

patient, prostrate or unable to move; and families can stay longer and closer to the patient, and have more direct contact with health personnel.

2. For health personnel in primary care (PHC), or first contact: New possibilities to consult with specialists; the possibility of avoiding inconvenient displacements; more elements of judgment when making decisions, being able to verify diagnoses and request a second opinion with the specialists; improves the quality and timeliness of the background to be able to diagnose. It also improves the flow of information transmission, avoiding the loss (or duplication) of reports and exams; grants the possibility for training and training of health professionals, through continuing medical education.

3. For hospitals: Reduction of the risk of loss of exams and images; faster and more accurate diagnoses and treatments; better and faster communication between different services; eliminate duplicate information; more effective care equipment and services; greater economy in the expenses derived from the transportation of patients; and an optimization of internal administrative processes.

4. Advantages for the health system: Better use and use of resources (physical, human, and financial); better management of public health and the health care network; additional resources for teaching students; more flexible and timely scientific and statistical analyzes; an increase in the accessibility of information at all levels of care; and allow the establishment of medical support networks at the country level.

2.3.2 Potential drawbacks or challenges of telemedicine

Also, the introduction of telemedicine sometimes has its disadvantages, or potential drawbacks for its correct implementation. Among which:

- Less accuracy for the diagnosis of certain images transmitted with telemedicine in relation to the original images, if the ICTs are appropriate for us. There is a risk of loss of data and images (resolution) due to the compression of said data to increase the transmission speed.

- Aspects linked to security and confidentiality in the doctor-patient relationship through appropriate interfaces, with possible legal and ethical implications.

- Increase of the demand to the specialists, being able to reach not being able to satisfy the high assistance volume of patients.

- The programs used in telemedicine should be compared with other alternative options, ensuring that in addition to offering very fast services are also viable services.

- Obstacles may arise during the implementation and setting up of this new technology, by health professionals, by the typical reaction to change, fear of losing their jobs, or lack of training.

- The implementation of telemedicine systems depends on an adequate telecommunications infrastructure. And, the technology and infrastructure must be sufficiently developed to support the implementation of large-scale

telemedicine; the aspects of good bandwidth and quality of service (QoS) are important.

- It is very important to have a diagnosis and survey of the real needs of the population so that the health services are not prey to the providers of equipment and services (and that they do not consider the real needs of the users). The programs used in telemedicine must be compared with other alternative options, to make sure that in addition to offering services with speed and quality, they are also viable services.

3. Status of telemedicine in Chile

3.1 Experiences and previous investigations

Health spending represents, in Chile, about 10% of GDP and grows at a rate close to 10%. This level of spending and growth is comparable to that of the OECD countries [8]. It is a known fact that if the efficiency in the use of resources is not increased, the maintenance of the system will be unsustainable, causing serious damage to the quality and life expectancy of the people. In this context, various technologies, services, and strategies have emerged in the world to empower them in order to overcome the current gaps (specialists, waiting lists, etc.) and those that are to come (chronic diseases, increasing life expectancy). Medicine currently has a development of therapeutic options greater in quantity and effectiveness than at any other time in its history. A fundamental concern lies in the ability of the health system to reach the people who require these therapies in an effective and equitable manner. The development of technologies that support clinical systems and health management provide an opportunity to shorten gaps in effective coverage that achieve the development of a fair and efficient health system.

In the case of Chile, there is a consensus on the urgent need to incorporate technologies and improvements in management. Therefore, a specialized strategic program is required to reduce gaps, catalyze and streamline regulatory processes, and the adoption of technologies and services, delivering measurable and demonstrable results in the short term that will position Chile as a leader in the region.

As previously mentioned, while several Latin American countries were advancing in telemedicine policies and plans, Chile did not appear in the specialized literature. Several initiatives and advances in this regard began to be developed. In Chile, telemedicine has been seen as a necessary solution to face the problems of coverage, shortage of specialists and care in remote areas, a problem that is especially relevant given the geography of the country. Thus, from 1993 onward, a series of public and private initiatives have been developed for the realization of telemedicine services. The development of these initiatives can be summarized in the following milestones that also mark the history of this discipline in the country.

The author of the chapter carried out an investigation to quantitatively know the specialty medical consultations based on the use of telemedicine. In Chile, given the information needs required by MINSAL (Ministry of Health), it is required that each establishment with an assigned DEIS code (recognized by the Department of Health Statistics and Information), report its production of attentions and population in control individually; to then consolidate it in the Health Service to which it belongs, and finally send it to MINSAL [7].

All the above information is consolidated in the REM (monthly statistical summary), which MINSAL receives in a timely manner from all the Health

Establishments in the country. Among them, there is REM-A07, which is used by all establishments with Medical Care of Specialties, such as: Therapeutic Diagnostic Center (CDT), Hospital Specialty Center (CAE), Health Reference Center (CRS), and Community Center for Mental Health (COSAM); and also all the PHC establishments (CESFAM) that have a specialist doctor. In particular, Section F of this summary corresponds to the provision of specialty medical consultation granted to outpatients from various primary health care centers or hospitals of low complexity, which require remote assistance from a Specialist Physician through the use of ICTs, registering the production of specialty consultations by telemedicine.

For the study, official data were requested from MINSAL, through requests for Transparency Law (public access); and the period between January 2014 and December 2016 (3 years) was included, considering that all specialties were already mature enough and in normal use. However, not all specialties have the same coverage in all regions of the country; and all the information that is delivered is available for confirmation. To date, seven categories are being registered and consolidated in the country: telecardiology, teledermatology, telepsychiatry, teleophthalmology, telenephrology, teleneurology, and other teleconsultations.

The different data were stored in a matrix repository. The global statistics of this original work are shown in the graph of **Figure 1**. With a universe of 139,763, registered care at the country level (for 36 months), correspond to 24,187 throughout 2014, to 44,906 in 2015, and 70,670 in 2016; representing a notable increase (292%) in said period. Of these, 58,281 correspond to men, and 81,482 to women. Of the total of them: 12,031 attentions for beneficiaries of less than 15 years, 62,348 of more 15 and less than 60 years; and to 65,384 for patients over 60 years of age. In **Table 1**, the medical consultations by telespecialty and age range are shown, and its graph is shown in **Figure 2**.

Figure 3 shows teleconsultation total by specialty (during the 36 months of study). In **Figure 4**, the evolution of the specialties during the 3-year investigation is shown.

According to the study, of the seven specialties, the largest medical consultations correspond to teledermatology (26.8%), teleophthalmology (24.7%), and telecardiology (22.1%) and those with the least registration are the telepsychiatry specialties (1, 5%), teleneurology (1.8%), and telenephrology (2.6%).
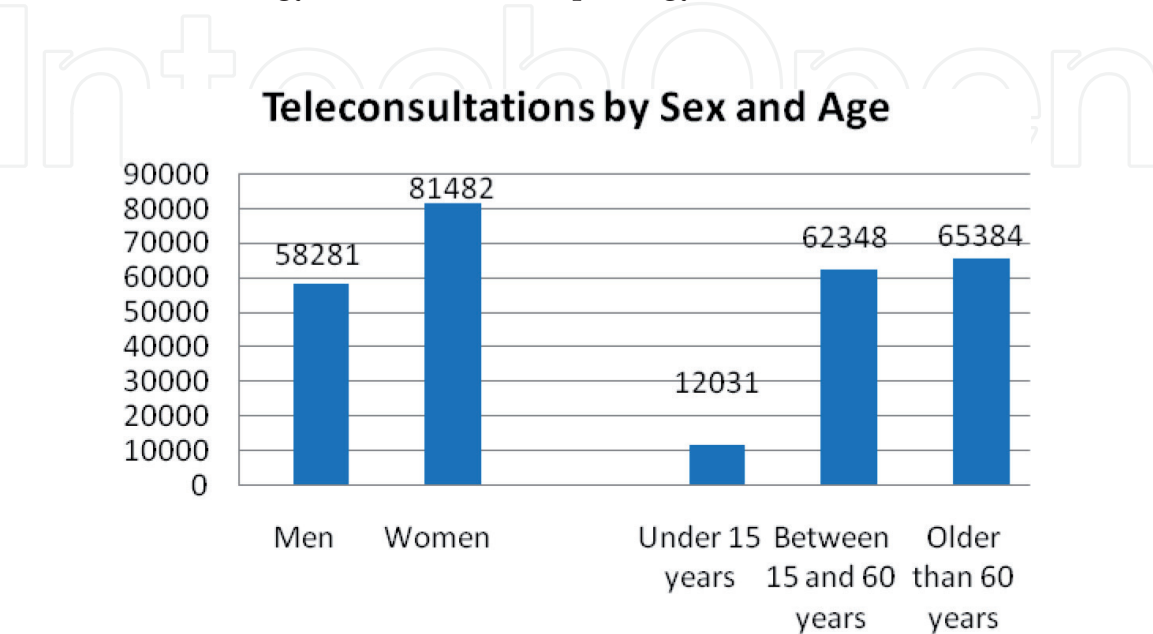

Figure 1.
Teleconsultations by sex and age (2014–2016).

Specialties	<15 years	15< years <60	>60 years
Telecardiology	419	16,022	14,486
Teledermatology	8992	17,932	10,500
Telepsychiatry	684	1076	288
Teleophthalmology	32	15,210	19,251
Telenephrology	18	837	2813
Teleneurology	455	1163	887
Other teleconsultations	1431	10,108	17,159
Total	12,031	62,348	65,384

Table 1.
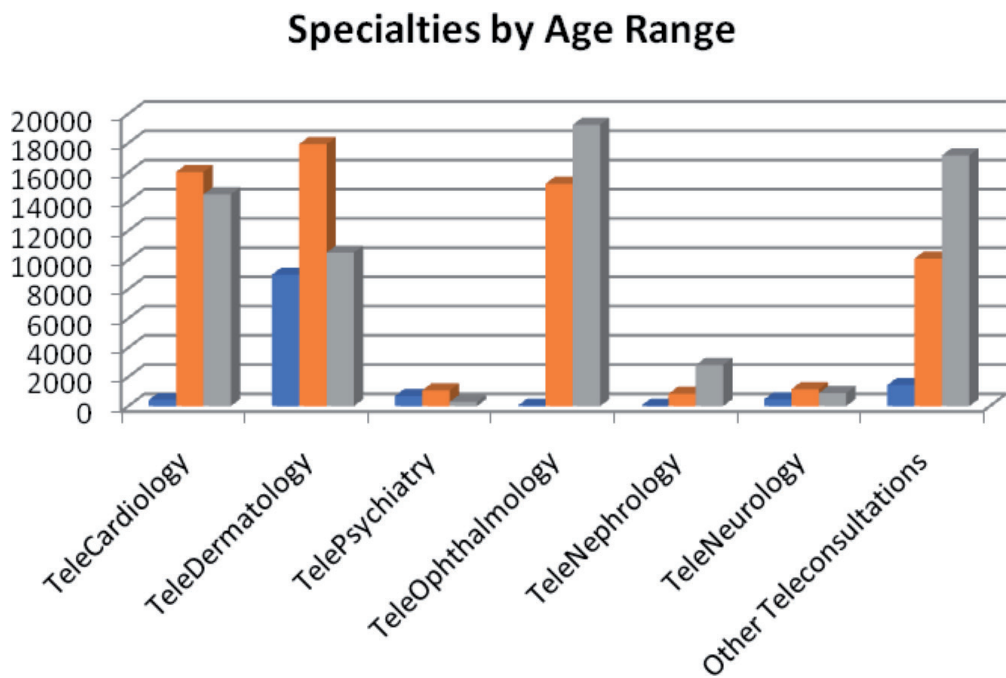*Specialties by age range (2014–2016).*

Figure 2.
Specialties by age range (2014–2016).

3.2 Projects and programs

As mentioned, currently, Chile does not have a directory that allows the possibility of publicizing and sharing the different experiences in telemedicine that have been carried out or are being carried out, either in the form of pilot plans, projects or stable programs. Based on the report "National Telehealth Program," and as another contribution by the author, the information was organized into categories according to the type of telemedical service that is delivered, and the direction of the flow of information was also defined, defining the derivative centers (who requests) and the telecenters of reference (who answers), indicating the telespecialty that is offered.

The records were grouped into three cases:

- Projects, which are cases in which different health facilities, by initiative and own funds, establish an agreement with a specialty reference center, and perform types of care according to the specialty they require, see **Table 2**.

- The National Strategic Programs, which are initiatives and actions initiated by the MINSAL and which establishes and finances the start-up of care in almost all health facilities in the country, is shown in **Table 3**.

- The Telemedicine Platforms and Committees are the telemedicine services provided by several specialized companies in this type of service, or Centers specialized in Telemedicine, see **Table 4**.

3.3 Legislative framework

In Chile, there is no specific legislation on Telehealth and/or Telemedicine, however, reference is made to International documents that propose the adoption and execution, by the Member States, of telehealth policies or e-health, as a strategy
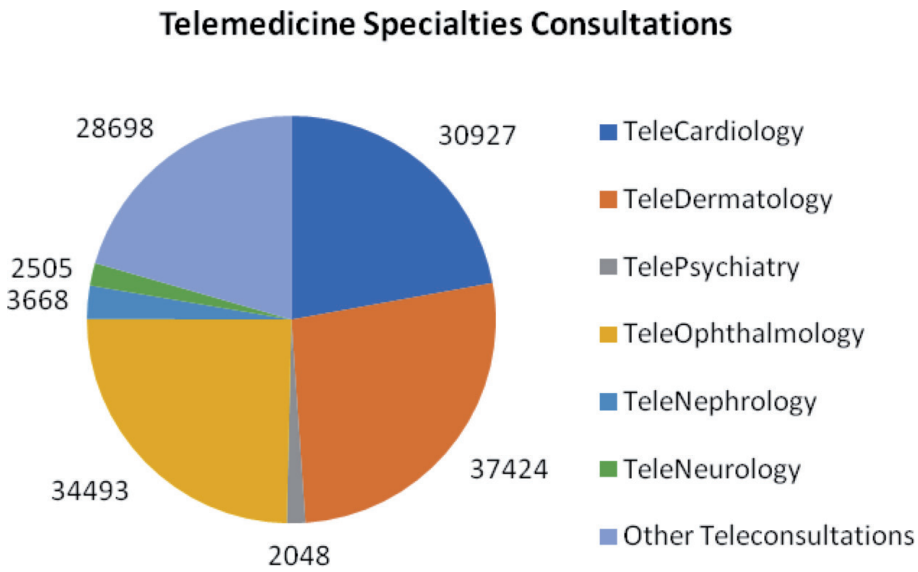

Figure 3.
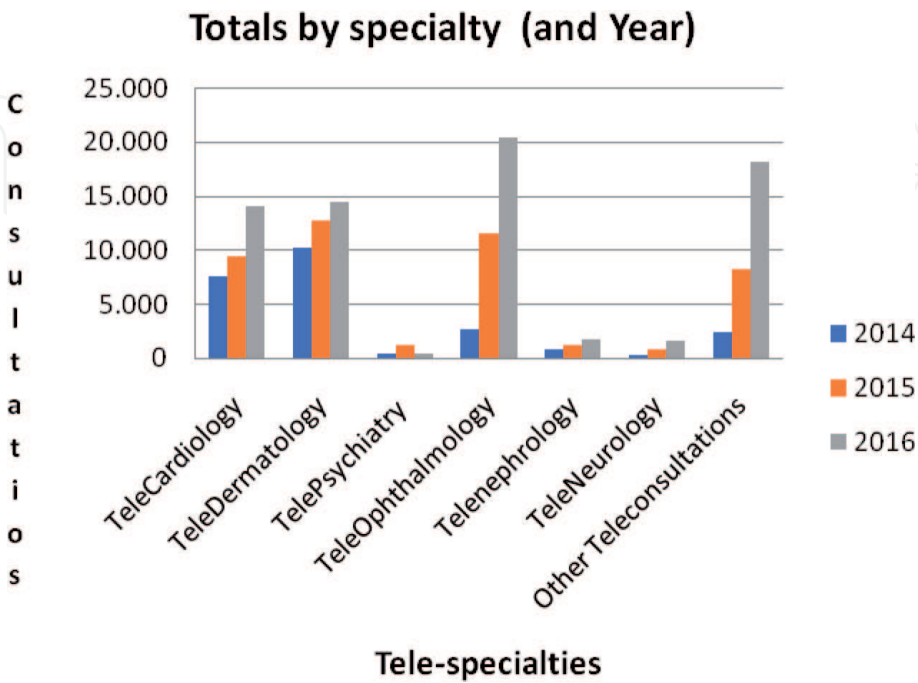*Teleconsultations by specialties (2014–2016).*

Figure 4.
Evolution of the telespecialties by year.

Year Start	Derivative Center	Reference Center	Classification	Project Specialty
1993	Universidad Católica	Dr. Sotero del Río Hospital	Telediagnosis	Comparison of traditional diagnosis vs telediagnosis
			Telecapacitation	Development of optimal methods of remote collaboration
1995	Clínica Alemana Temuco	Clínica Alemana Santiago	Telediagnosis	Teleradiology
1998	Juan Fernández Island	Clínica las Condes	Telediagnosis	Telediagnosis
2000	UCH Clinical Hospital	Js. Johns Hospital (EE. UU.)	Telecapacitation	Telecapacitation
2001	Carlos Van Buren Hospital	Universidad de Valparaíso	Telecapacitation	Transmisión de imágenes neuroquirúrgicas
2003	Antártica	UCH Clinical Hospital	Telemonitoring	Teleradiology
2009	San Carlos Hospital	Las Higueras Hospital	Telediagnosis	Telecardiology
	Linares Hospital			Telepsychiatry
	Angol Hospital			
2012	Queilén Hospital	Castro Hospital	Teleconsultations	Teledermatology
	Achao Hospital			
2012	Puerto Natales Hospital	Clinical Hospital Magallanes	Teleconsultations	Telecardiology
	Puerto Williams Hospital			Teledermatology
	Porvenir Hospital			Teleradiology
2013	La Calera Hospital	Gustavo Fricke Hospital	Teleconsultations	Telecardiology
	La Ligua Hospital			
	Petorca Hospital		Tele informes	
	Limache Hospital			Teleradiology
	Quintero Hospital		Telediagnosis	
2015	El Pino Hospital	Universidad de Santiago	Telediagnosis	Teledermatology
2015	Iquique Teletón	Santiago Teletón	Teleconsultations	Telerehabilitation
			Telediagnosis	
2016	UPC de Hospital Regional de Coyhaique	Hospital del Tórax	Telediagnosis	Teleurology
				Teletraumatology
			Telecare	Telepsychiatry
				Teleneurology
2017	Los Ángeles PHC Centers	Concepción Teletón	Teleconsultations	Telerehabilitation
			Telediagnosis	
2017	Quillota Hospital	Gustavo Fricke Hospital + Hospital Carlos Van Buren Hospital	Teleconsultations	Telecardiology
	La Serena Hospital			
	San Felipe Hospital			
	Antofagasta Hospital			
2017	Molina Hospital	El Maule Health Service	Telediagnosis	Telepsychiatry
	Curepto Hospital			
	Constitución Hospital			
	Hualañé Hospital		Telemonitoring	
	Chanco Hospital			
	Licantén Hospital			
	Longaví Commune CESFAM			
2017	Sename	CIMT + UCH Clinical Hospital	Teleconsultations	Telepsychiatry
2018	San Martin Hospital	Barros Luco Hospital	Telemonitoring	Tele Trombólisis or Tele ACV
			Telediagnosis	
2018	San Martin Hospital	Gustavo Fricke Hospital	Telediagnosis	Attention of specialists and subspecialists
	Quilpué Hospital		Teleconsultations	
2018	Magallanes Hospital	UCH Clinical Hospital	Telecare	Telerehabilitation
			Teleconsultations	Telepsychiatry
				Telegenetics
2018	CESFAM Semilleros	Las Higueras Hospital	Telediagnosis	Teleneurology
	CESFAM Paulina Avendaño, Talcahuano			
	CESFAM San Vicente, Talcahuano		Teleconsultations	
	CESFAM Los Cerros, Talcahuano			
	CESFAM Hualpencillo de Hualpen, Comuna de Tomé		Telemonitoring	
	CESFAM Alberto Reyes, Comuna de Tomé			

Table 2.
Main telemedicine projects.

to improve health of those States. In this regard, the World Health Organization, in 2005 agreed Resolution WHA.58.28, adopted at the 58th World Health Assembly, which indicates that there was awareness that advances in information and

Year Start	Derivative Center	Reference Center	Classification	Program Specialty
2009	29 Health Services	Dermatology Center	Teleconsultations	Teledermatology
2012	Hospitals of low complexity and PHC	28 Health Services	Teleconsultations	Contact of specialists of hospitals of medium / high complexity with doctors in training in hospitals of low complexity or PHC
			Telecapacitation	
2014	María Pinto, Alhué y Curacaví Centers	San José de Melipilla Hospital	Teleconsultations	Teleconsultations in patients who require anticoagulant treatment
		Peñaflor Hospital		
		San Juan de Dios Hospital		
	Curacaví Hospital	San Juan de Dios Hospital		
	Isla de Maipo y El Monte Communes	Talagante Hospital		
2014	PHC Centers	San Borja Arriarán Hospital, Metropolitano Central Health Service	Telereports	Child Neuropsychiatry
2016	El Pino Hospital	Metropolitano Sur Health Service	Teleconsultations	Telecardiology
	Talagante Hospital			
	Copiapó Hospital			
2016	Rancagua Hospital	Tórax Hospital	Telemonitoring	Telemedicine for Extracorporeal Oxygenation Therapy
	San Fernando Hospital			
	Coyhaique Hospital			
	Castro Hospital			
	San Camilo Hospital			
	Padre Hurtado Hospital	Sotero Del Rio Hospital		
	La Florida Hospital			
	Gustavo Fricke Hospital			
	Quillota Hospital			
	Quilpué Hospital			
	Carlos Van Buren Hospital			
	El Pino Hospital			
	Complejo Asistencial Barros Luco			
2017	Copiapó Hospital	Carlos Van Buren Hospital	Teleconsultations	Neuro Surgical Telemedicine Network
	Vallenar Hospital			
	La Serena Hospital			
	Gustavo Fricke Hospital			
	San Camilo Hospital			
	Los Andes Hospital			
2017	Arica Health Service	Roberto del Rio Hospital, Metropolitano Norte Health Service	Teleconsultations	Telemedicine in Network of Operable Congenital Heart Diseases
	Atacama Health Service			
	Coquimbo Health Service			
	Valparaíso-San Antonio Health Service			
	Metropolitano Central Health Service			
	Servicio de Salud Metropolitano Sur			
	O'Higgins Health Service			
2017	29 Health Services	Public Assistance Hospital, Metropolitano Central Health Service	Teleconsultations	Telemedicine in a network of serious burns
			Telereports	

Table 3.
Main National Telemedicine Programs.

communication technologies have generated expectations regarding health; and recalling resolution WHA51.9, he emphasized that e-health consists of the support that the cost-effective and safe use of information and communication technologies offers to health and related fields, including health services, health care, health surveillance and documentation, as well as health education, knowledge, and research [4], and urged the Member States to develop and promote a range of activities, including the establishment of national networks and centers of excellence working on e-health, and in particular on exemplary practices, policy coordination, and technical support for the delivery of health care, improvement of services,

Year Start	Derivative Center	Reference Center	Classification	Program Specialty
2005	Emergency Primary Care Services (all the country)	Report Central	Telereports	Telecardiology
2005	General Access	Salud Responde	Telecapacitation / Teleassistant	Teleconsultations
2009	29 Health Services		Teleconsultations	Teledermatology
2012	Talcahuano Health Service / Concepción Health Service / Arauco Health Service / Ñuble Health Service / O'Higgins Health Service / Metropolitano Sur Oriente Health Service / Metropolitano Norte Health Service / Reloncaví Health Service / Metropolitano Occidente Health Service	Cardiovascular Health Program	Telereports	Telenephrology
2013	124 Ophthalmological Primary Care Unit	Teleophthalmology Platform	Telereports	Teleophthalmology
2016	Specialty Centers of the country	VIH Network (Lucio Córdova Hospital)	Telerehabilitation and teletreatment	Telemedicine VIH Net
2017	San José Hospital, SSMN	RIS/PACS Platform	Telereports	Teleradiology
	Roberto del Río Hospital, SSMN / Instituto Nacional del Cáncer, SSMN		Telediagnosis	Teleimaging
2017	Dr. Juan Noé Crevani Hospital	Cardiological Committee on Congenital Heart Diseases Operable by Telemedicine (Metropolitano Norte Health Service, and Cardiological Equipment of the Roberto del Río Children's Hospital) - SSMN	Telediagnosis	Telecardiology
	Copiapó Hospital / La Serena Hospital / Carlos Van Buren Hospital / El Carmen Hospital / El Pino Hospital / Dr. Exequiel González Cortés Hospital / Barros Luco Trudeau Hospital / Rancagua Hospital		Teleconsultations / Telemonitoring	
2018	Concepción Hospital	Oncology and Radiotherapy Center	Telerehabilitation	Teleradiology
	Herminda Martin Hospital		Telediagnosis	

Table 4.
Main platforms based on telemedicine.

information to the citizen, development of means of action and surveillance. In relation to the legal norms that allow and sustain the development of the Telehealth Program, we can mention as the first foundation the Political Constitution of Chile, in its Article 19, numeral 9, this ensures all the people the right to health protection and establishes as a duty of the State to protect free and equal access to actions for the promotion, protection and recovery of health and rehabilitation of the individual.

On the other hand [4], Article 3 of Law No. 18.575, Constitutional Organic General Bases of the State Administration states that: "The State Administration is at the service of the human person; Its purpose is to promote the common good by

attending to public needs in a continuous and permanent manner and promoting the development of the country through the exercise of the powers conferred by the Constitution and the Law, and the approval, execution and control of Policies, Plans, Programs and Actions of national, regional and communal scope."

The aforementioned standards constitute an obligation for the State and that is why actions must be taken to ensure access to health care, whether these actions are carried out in a conventional manner or whether new strategies should be implemented.

In addition, Article 1, DFL N°1, of 2005, of MINSAL, which establishes a consolidated, coordinated, and systematized text of Decree Law No. 2763 of 1979 and of Law Nos. 18,933 and 18,469 reinforces the provisions of the Political Constitution and establishes the responsibility of the Ministry of Health to guarantee such right, as well as to coordinate, control, and when appropriate, execute such actions. According to the above, in our country telehealth strategies will be implemented within the framework of current regulations and associated with defined clinical-care processes, complying with the standards of face-to-face care [4].

In relation to the applicability of the telemedicine modality in the health benefits associated with the Auge-GES and non-GES Plans (pathologies with and without guarantees), and regarding the legal medical liability associated with this benefit, the Legal Division of MINSAL has informed, through Memorandums A15 N°04995, of December 31, 2013 and Memorandum A 15 N°0223, of September 3, 2015, as follows: "Under the modality of telemedicine it is possible to incorporate that set of medical assistance procedures that are materially executed remotely, using different means of communication and image technologies, in order to collaborate in the care of health and ranging from clinical background and examinations to technical assistance in medical work of any kind, such as invasive and non-invasive procedures, which are developed remotely and under specific professional supervision." Also, "Telemedicine is part of collaborative professional procedures that contribute to the health care of people and that is linked to other procedures and professional and technical actions performed by professionals, technicians, and administrative staff in health. In this case, the work of assistance developed by telemedicine by an ad-hoc professional, as the case may be, is delivered to a health team responsible for the face-to-face care of a person, for the formulation of due care that includes diagnosis and treatment of the case."

In addition, it is contemplated that [4, 14]:

1. Law No. 20,584, which regulates the rights and duties of people in relation to actions related to their health care, establishes with respect to informed consent, in Article 14, that this is required for all health care and it will generally be done verbally. Notwithstanding the foregoing, the patient's consent must be recorded in writing in the case of "surgical interventions, invasive diagnostic, and therapeutic procedures and, in general, for the application of procedures that involve a relevant and known risk to the health of the affected person."

2. Telemedicine care in Specialty Consultation whether Ambulatory, Hospitalization or Urgency, is not an invasive procedure or that involves significant risk to health. Nor are the reports of procedures or examinations carried out by telemedicine. In this context, it is not necessary to have a signed record of such consent, it being understood that, in the act of medical care, the professional explains to the patient the process of care to be developed through telemedicine and the continuity of care associated with it. In addition to the above, it must be considered that the benefits to be developed by telemedicine must be defined in the Portfolio of Establishment Services and Derivation Map, which must be informed to the Community. The Information and Communication Technologies (ICTs) to be

used as support for telemedicine services must comply with the Information Security issued by MINSAL and with the provisions of Law No. 20,584 that regulates the rights and duties of people in relation to actions linked to their health care and Law No. 19,628 on the protection of privacy. At this point, mention that if the established is fulfilled, a written record of informed consent is neither required to take photographs in the context of medical care, nor to record a telemedicine care performed by the MINSAL Videoconference Network, in a context of critical care or of urgency and that it is required to support for possible future audits. In that sense, article 5, letter (c) of the aforementioned Law No. 20,584, states in relation to the right to a dignified treatment, that providers must "Respect and protect the privacy and honor of the person during their health care. In particular, these rights must be ensured in relation to the taking of photographs, recordings or films, whatever their purpose or use. In any case, for the taking of photographs, recordings or filming for journalistic or advertising purposes or uses, written authorization from the patient or his legal representative will be required." In this way, it is possible to conclude that those recordings or taking photographs for purposes other than journalistic or advertising, do not require the express authorization of the patient, however, the protection of their rights.

It also details several important ethical aspects that should be considered for telemedicine care [4].

4. National program

4.1 Objectives

As mentioned previously, while several Latin American countries developed policies and programs in telemedicine, others did not. The CORFO (Production Development Corporation) created, from April 2015, a Strategic Program "Health + Development," whose main objective was to strengthen the environment for the development of the services, technologies, and health management industry; and ways to effectively contribute to improve the national health system and the quality of life of patients [8]. The program aims to generate sectors capable of producing new goods and services, develop industries, and generate poles of innovation. Then the National Telemedicine Day was held in the city of Valdivia (July 2015) [15]. And in order to continue advancing in the area, it was created in conjunction with the National University Network (REUNA), a working group composed of representatives of different universities, CORFO, Ministry of Health, FONASA, CEPAL, REUNA, and RUTE (University Network of Telemedicine, Brazil), where the advances in the area of telemedicine were discussed and the main challenges that needed to be addressed for its growth.

There was a collective consensus on the need to have a telemedicine policy, which finally progressed toward a National Telemedicine Program, which provides a conceptual framework and technical, strategic, administrative, organizational, and financial guidelines for the development and optimal functioning of the strategies of telemedicine that are already installed in the Health Networks of Chile.

As part of the Strategic Health and Development Program, the Ministry of Economy, Development, and Tourism requested the RAND Health Corporation to create a roadmap to guide the development of information technology (ICT) in health in the public health system in Chile. This project had two phases. For the first phase of this project, the current status of the adoption and implementation of ICT in health in Chile is described. For the second phase, a roadmap was designed that focuses on key

objectives and activities designed to foster growth in the adoption and successful implementation of health ICTs in the public sector in Chile, including telemedicine [16, 17].

If we focus on the competitive advantages, in terms of clinical and hospital services (public and private), Chile is next to Brazil, a leader in the region. In terms of connectivity, another crucial element to develop this type of industry, the country ranks 35 out of 144 according to the ranking of the World Economic Forum (WEF) [8]. Just to compare, Colombia ranks 63rd in the ranking, Brazil ranks 69th and Mexico 79th in the same ranking [1, 2]. Finally, Chile has been a pioneer in the implementation of fiber optic connections for the transfer of complex and high-speed information, highlighting in particular the effort made by the National University Network (REUNA) and the austral cable project currently under study. On the demand side, the main driver for the development of this program, we find a health sector where public and private spending increases steadily as a consequence of factors such as the aging of the population, the increase of chronic diseases and the growing lack of specialists. Only by way of example, spending on health in the public sector has increased only 11, 8% in the last year, reaching almost 8% of GDP as reported by the Government's Budget Office.

Based on what was stated in point 3, for the current development of Telehealth it was required to address in a Program [4], the following areas:

- Decrease of access barriers, improving the opportunity and continuity in the attention of the user population, for the satisfaction of their health needs.

- It will allow to diminish the impact of the deficit of specialists in areas that present gaps in the country.

- It will allow the optimization of existing resources in the Network, positively impacting the pocket expense15 of the population.

- It will favor the technical transfer from the health teams between the different levels of care, facilitating training, and continuing education. Also, the interrelation between professionals for the promotion of good professional practices.

- It will allow to define the technical competences of the human resource, its functions and profile according to the actions to be developed in the different components of the program.

- Having organizational definitions of the program will facilitate its development and implementation in places where it is not yet installed. By defining its organizational aspects will allow the program to develop and maintain in time independent of the political changes that occur in the country.

- It will allow improving communications coverage, connectivity, and its quality, and the equipment required for telemedicine actions.

- It will help to clarify the legal, ethical, and regulatory framework existing in Chile, for the application of telemedicine and will lay the foundations for a future technical standard.

- By defining its organizational aspects will allow the program to develop and maintain in time independent of the political changes that occur in the country.

- It will favor the interrelation between professionals for the promotion of good professional practices.

This Program defines Telehealth in Chile as: a strategy based on the Model of Comprehensive Care of Family and Community Health [4], in the context of Integrated Health Services Networks [4], and that through the use of technology information and communications, facilitates the provision of distance services from the field of promotion, prevention, diagnosis, treatment, rehabilitation, and palliative care, focused on the person in their socio-cultural context and throughout their life course, with the purpose of maintain an optimal state of health and continuity of care for the population, thus improving equity in access, exercise of rights, opportunity, and quality of care through its three components: tele-education, telemedicine, and telecare.

The general objective of the Program is: to generate the technical, technological, administrative, organizational, and financial conditions to develop the three components of Telehealth in the Health Services, and in this way contribute to improving access and equity in people's integral health, and the fulfillment of the health objectives of the decade 2011–2020. The principles, specific objectives, and associated characteristics are detailed in the Program itself.

4.2 Lines of action

The lines of action of the Telehealth program in Chile are based on three components [4], as shown in **Figure 5**.

4.2.1 Tele-education

The general objective is to provide a form of continuous learning, applied to educational processes that integrate the various components and actors, through the use of Information and Communication Technologies, favoring the transfer or generation of knowledge without restrictions of space, time, or distance. It is a planned training and learning process, developed with the support of Information and Communication Technologies, aimed at both the internal and external user and the community, within the framework of a flexible process in time, space, and form, facilitating this accessibility to the formative meeting.
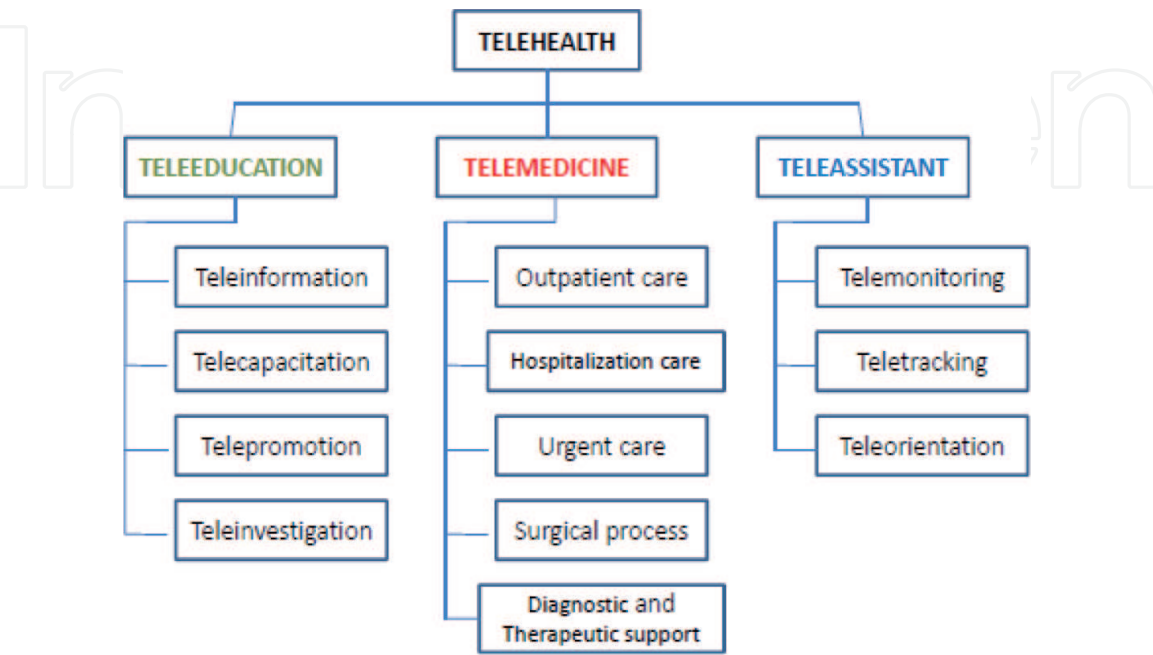

Figure 5.
Lines of Action Nation Program.

4.2.2 Telemedicine

The general objective is to grant attention and care with the use of telemedicine strategies for the delivery of medical and non-medical remote health services with timely access and quality standards to health care that also reinforces networking, establishing permanent links that ensure the continuity of people's attention. The areas of application of telemedicine correspond to the following Processes: Open Care Process: Primary Health Care; Ambulatory Specialties Care; Attention Process in Hospitalization: Hospitalization Care; Emergency Care Process: Attention in PHC and Hospital Emergency Unit; Surgical Process: Major Ambulatory Surgery-Surgery of Greater Complexity; Diagnostic and Therapeutic Support Process: Procedures, Exams, Analysis samples.

4.2.3 Teleassistant (or Telecare)

Its objective is to allow people to connect with the health network, coordinating the available resources and devices. Involves direct and bidirectional actions, between a person outside a health facility and a team and/or an application, which interact through health information and communication technologies (TIC) for the maintenance, control and improvement of individual health. It has three areas of action: Telemonitoring, Teletracking, and Teleorientation.

5. Conclusion

In this chapter, I wanted to enumerate the different experiences related to telemedicine in Chile, the advancement, the main characteristics, and expectations of the National Program of Telemedicine. I summarized the main concepts involved and the advantages, disadvantages, and challenges that this discipline faces. I have included some research done by me as a contribution to the development of the telemedicine in the future. It is a first version which can be supplemented and improved later.

Conflict of interest

The author declares that he does not have any conflict of interest.

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