CURRENT STATE OF TELEDENTISTRY IN CHILE

Carlos Zaror DDS, MSc, PhD[1,2], Carolina Vergara-González DDS, MSc[3], Natalia Ibalaca BN, MBA[4], Juan Pablo Olmos MT, MSc[4], Silvana Perez DDS, MSc[5]

[1] Centre for Research in Epidemiology, Economics and Oral Public Health (CIEESPO), Faculty of Dentistry, Universidad de La Frontera, Temuco, Chile
[2] Servicio de Salud del Reloncaví, Puerto Montt, Chile
[3] Servicio de Salud Aysén, Coyhaique, Chile
[4] Departamento de Integración de la Red Asistencial, Ministerio de Salud, Santiago, Chile
[5] Hospital Base de Valdivia, Valdivia, Chile

Abstract

Chile is a country where the geography and territorial distribution of the population make healthcare a constant challenge. Despite a reported improvement on oral health indicators, some levels of inequality are still noted in terms of access to healthcare services. In this context, teledentistry has been considered an effective tool to respond to the population's healthcare needs. The aim of this paper is to present the current state of teledentistry in Chile. This paper describes the initiatives and programmes of teledentistry developed in Chile, the ethical and legal aspects, financing sources and pending challenges for its consolidation. It is expected that teledentistry will contribute toward an increase in coverage and access to specialists, improve the appropriateness of referrals and reduce costs of specialist care.

Keywords: telemedicine; health services; oral health; teledentistry; Chile

Introduction

Chile is a country where geography (a narrow, 6,500 km strip of land running North to South along the Pacific coast of South America)and the territorial distribution of the population (a densely populated central region around Santiago, to sparsely populated Northern and Southern extremities) make healthcare a constant challenge. Forty percent of the population is concentrated in the capital, Santiago and 13.4% of the population live in rural areas.[1]

The Chilean healthcare system is mixed, comprised of both state-run insurance called the National Health Fund (FONASA) and private sector insurance called ISAPREs (health insurance companies). FONASA covers approximately 80% of the population through the National Health Services System (SNSS) and its network of 29 Regional Health Services, and the Municipal System of Primary Care. ISAPRE covers approximately 17% of the population and provides services through private and public facilities. The remaining 3% are covered by the Health Services of the Armed Forces. The Ministry of Health is responsible for formulating public policies and regulating the actions of the institutions that provide healthcare.[2,3]

Currently, although health indicators in Chile have been improving and stand out in relation to neighbouring countries, high levels of inequality are noted in terms of access to health services, and there are sectors of the population which, due to distance from health centres or socioeconomic barriers, do not receive timely attention. This situation is especially critical in the area of oral health, where disease indicators are particularly unfavourable. Epidemiological studies report that the prevalence of oral pathologies in Chile can reach 90% in the case of dental caries, and nearly 50% in the case of dento-maxillary anomalies (DMA), periodontal disease and dentoalveolar traumas.[4-7]

In this context, telemedicine in Chile has been considered an effective strategy to respond to the population's healthcare needs. During the past few years there have been many initiatives launched with the aim of having an impact on the quality of some services and contributing to the efficient use of the sector's resources. Telemedicine development began in 1993, however, the first national initiative promoted by the Ministry of Health was the implementation of telecardiology. Later other programmes were implemented, such as teledermatology, teleradiology and tele-ophthalmology among others.[8] In 2011, the Ministry of Health created the Department of Sector Management of Information and

Communications Technologies in an attempt to boost digital health strategies, which resulted in the design of an eHealth Plan.[9] In 2018 the National Telehealth Plan was published, which provides a conceptual framework and guidelines on the use of information and communications technologies (ICTs) in fulfilling the decade's health objectives, with telemedicine being one of the tools that offers extensive possibilities, and, as a branch of this, teledentistry.[8]

Chilean Experience

In Chile teledentistry remains in a developmental phase; however, there is increasing clarity on the need to incorporate this modality as an effective tool. The National Telehealth Plan describes an area of activity for telemedicine in dentistry as promoting outpatient specialist care in order to bring specialised attention to the users through communication via ICTs on primary and secondary care. It is expected that both the initial consultations as well as the check-ups could be carried out using this modality.[8] Although there have been initiatives in teledentistry, a standardised registration system of dental consultations conducted by telemedicine in the public healthcare system began in 2018. Between January and October 2018, 1,090 consultations took place via teledentistry.[10] Currently, the dental specialties with established nationwide strategies are Oral Pathology and Orthodontics.

Oral telepathology

Telepathology began to develop from 2016 in the context of the strategy for the prevention and early diagnosis of cancerous lesions, where one of its defined lines of action was oral pathology. The Oral Pathology strategy addresses the early detection of oral cancer. It consists of sending a clinical history and photographs of the oral cavity from the primary care dentist to a specialist in oral pathology in a general hospital via a technological platform. The specialist assesses the history and provides diagnostic guidance and recommendations for management and/or treatment.[8]

In 2017 a pilot programme was implemented in three Health Services: Concepción, Ñuble and Arauco, with 285 consultations in oral pathology being done in that year.[10] The programme consisted of a referral from primary care based on protocols of dental referral and counter-referral, to which was added relevant information for the diagnosis of tumour lesions as well as photographs of the lesion. These were then assessed by professional oral pathologists at the hospitals. The process of counter-referral from secondary attention can incorporate activities for primary care, referral to another specialty or in-person care with the specialist.[11] Remote consultation in oral pathology takes place via a platform or application designed for this specialty, and the first stage of implementation is training for the general dentists in primary care facilities.[11]

Since October 2017, a monthly meeting of oral pathologists in the network has taken place to make a continuous assessment of the process and work on standards in diagnosis and therapy. The programme was strengthened in 2018 by the provision of equipment such as cameras, intraoral mirrors and mouth separators to improve quality and accuracy in the diagnosis. By 2020 it is expected that all the country's health services will implement the oral telepathology programme.

Tele-orthodontics

The country's first tele-orthodontics programme was started in the Region of Los Ríos, in southern Chile, under the auspices of the Health Service of Valdivia. This region has high rates of poverty (17.4%) and rurality rates (29.4%), both above the national average.[1] The programmes' main referral centre for DMA treatment is the Hospital Base de Valdivia. Dental referrals represent 36.8% of the consolidated regional referrals received by the Hospital, and 3,500 of them correspond to orthodontics.

In response to this problem, an Orthodontics Network of the Los Ríos region was created. It included a general dentist (primary healthcare) and orthodontists (specialist care) from the Hospital Base de Valdivia. The aims were: to improve communication between care levels, improve the efficiency of resources, resolve malocclusions in primary healthcare and improve the relevance of the referral. The Orthodontic Network was the starting point, in order to participate in the network of Telemedicine of the Valdivia Health Service.

The initial six-month pilot programme of tele-orthodontics began in 2015 in remote rural areas, in three health centres. Subsequently all of the remaining health services centres in the region were incorporated.

This programme seeks to: improve access to and opportunity for consultation with a dentist; reduce inequity due to geographic location; strengthen primary healthcare with respect to the professionals' competencies in diagnosis, prevention and early treatment of DMA; collaborate in the resolution of cases of patients in the network with anomalies that can be treated; provide continuity of care, improving user satisfaction.

This programme is based on remote consultation via an Internet platform system called Rasvaldivia to store and send information. The patients included are skeletal Class I in early interventional orthodontic treatment in the referring dentist's office. The general dentist produces a dental referral, which includes all the history required according to a pre-established protocol. Once this history has been received, the specialist can ask for new information or examinations, set a time for a videoconference in real time or respond definitively to the consultation.

In addition, the platform makes teletraining possible, facilitating the ongoing training of dentists in the network as well as of new professionals entering the Region of Los Rios health network. This educational content strengthens their preventive and therapeutic technical abilities and provides insight to clinical guidelines for suitable resolution of cases.

This project began in 2015 by training the dentists in the prevention and early treatment of DMA to improve the appropriateness of referral and facilitate the resolution of the

different malocclusions through orthodontics treatment in the referring care centre. In the second stage, the implementation was managed through the purchase of the necessary equipment and use of the internet platform. Finally, in 2017 the pilot programme was launched in the health centres in the most remote rural areas and with the most remote access.

This strategy has allowed an increase of preventive and therapeutic actions in primary healthcare, significantly reducing the number of referrals to the Orthodontics specialty and increasing the number of tele-orthodontic cases per year. (Figures 1-3)

Given these successes, the Orthodontics Network is expecting final approval of a new modality programme for referrals. It is anticipated that tele-orthodontics will become the only means to request a specialist´s care in this area, thus avoiding dual processes and ensuring that everyone has access to a specialist.

Ethical and legal aspects

Although there is no specific regulation on telehealth and telemedicine and therefore teledentistry in Chile, there are certain policy frameworks to orient the strategy. While the World Health Organization (WHO) does not issue obligatory regulations for Member States, it offers a certain framework of action that countries can use as guidelines.[12] In this context, the WHO calls upon the states to formulate strategic plans that include ICTs, respecting the corresponding policy, legal and ethical frameworks.[12]

In Chile, ICTs used to support telemedicine services must comply with the Information Security policy issued by the Ministry of Health, Law Nº 20.584 which regulates the rights and responsibilities people have regarding healthcare actions, and Law Nº 19.628 regarding the protection of private life.[13] These protect care using telemedicine and allow its different actions in the context of outpatient or emergency care, such as taking photographs for medical care or recording a telemedicine appointment done through the Ministry of Health's Videoconference Network. All this occurs with the implicit understanding that telemedicine does not constitute an invasive procedure nor a relevant risk to health.

In relation to the applicability of telemedicine to health services and the associated medical-legal responsibility associated with this service, the Ministry of Health has established that "care performed via telemedicine by an ad hoc professional, as the case may be, is handed over to a healthcare team responsible for the in-person care, for the formulation of the necessary care that includes the diagnosis and treatment of the case". Therefore, there must be a medical team for an in-person assessment that performs the medical tasks; the telemedicine procedure is viewed as a technical support provided collaboratively based on providing the most effective health service possible and according to the referred patient's needs.[8]

Financing

Public healthcare services are financed with general taxes, contributions made by the municipalities and co-payments

made by FONASA affiliates. All workers are obligated to contribute to the healthcare system 7% of their taxable income and can choose to pay it to FONASA or to an ISAPRE.[2] The Ministry of Health controls spending through FONASA. This fund collects the resources of the affiliates' contributions and the national funds allocated to the needy as
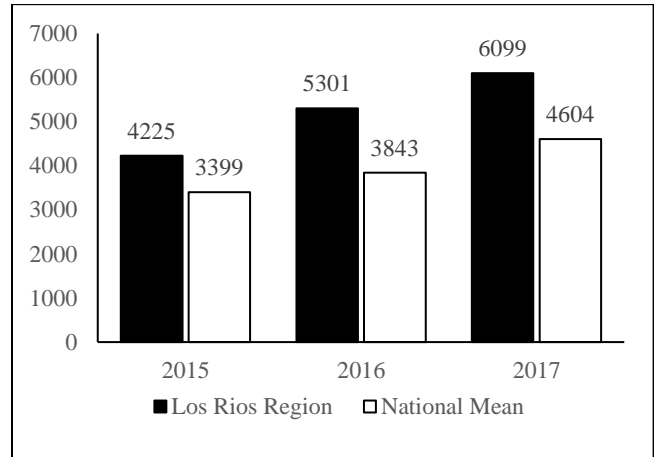

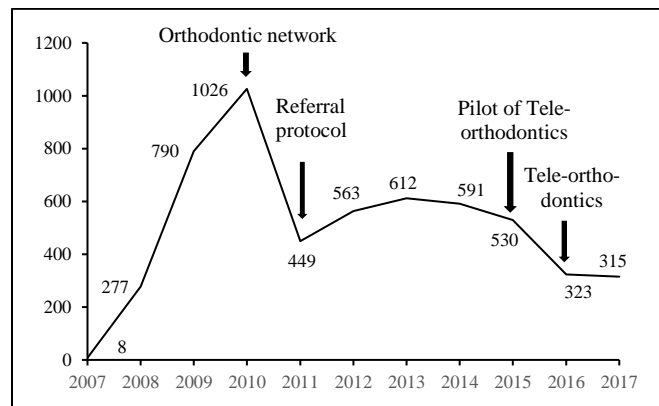**Figure 1.** Mean number of treatments in primary healthcare per year (2015-2017).

Figure 2. Number of referrals to the Orthodontics specialty per year (2006-2018).
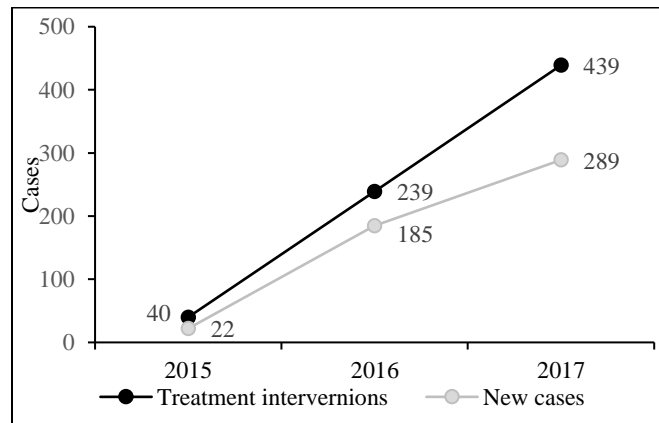

Figure 3. Number of tele-orthodontic cases per year (2015-2017).

well as the resources of the public health programmes and assigns them to the facilities belonging to the SNSS based on historical budgets. Allocations are for high-priority issues or per capita allocations as is the case for the municipalities.[2,14] The distribution of these resources to the various facilities in the SNSS network is done through transfers to the Primary Healthcare Programme (APS), to the valued services programme (PPV) and to the institutional services programme (PPI), which in turn redistribute the resources to the regional health services.[2,14]

Initially, telemedicine in Chile was implemented with centralised financing from the Chilean Ministry of Health, mainly for the purchase of equipment and the computer system. Later, it was reinforced by various financial strategies such as pre-investment projects by the hospitals, an effectiveness plan by the primary care division, regional governments and others. From an operational point of view, the one that registers the output is the specialist who provides health services through telemedicine. This is financed through PPV, programmed by each facility that offers telemedicine or teledentistry according to the specialist offering.

Other experiences
A series of local initiatives has been launched in several regions in Chile at the level of the Health Services or under the auspices of state-run universities. Many of these initiatives have the support of the Telemedicine Unit of the Chilean Ministry of Health.

Teledentistry for southern Chile
A new initiative that is in the implantation phase has been organised in the Health Service of Reloncaví. The Health Service of Reloncaví (SSDR) is responsible for providing integrated health services in the Province of Llanquihue and Palena at both primary and secondary levels, to an approximate population of 434,746 individuals (estimated for 2014, based on the 2002 Census). The Hospitals of Puerto Montt and Calbuco are the only ones in the network that have all the dentistry specialties and must cover the largest share of the demand emanating from the primary care facilities that comprise the network.

Approximately 32% of this population belong to communities with a large number of rural areas[1] many of which are islands. These locations are far removed from the health centres that provide secondary care and have infrequent public transportation, which often makes it impractical to visit a health centre of medium or high complexity to receive specialised attention.

This programme consists of a teledentistry system with a storage/shipment modality and synchronous (real time) consultation for different specialties. Its primary aims are to reduce the waiting list, improve the appropriateness of referral, solve diagnostic questions and guide the handling of complications. The specialties to be addressed will be orthodontics, maxillofacial radiology, oral rehabilitation, oral surgery, endodontics and paediatric dentistry

(dentoalveolar trauma). In addition, teledentistry will be supported by on-site dental visits, which will make it possible to close the cases that have not been solved by remote attention, with the goal being not to have an internal waiting list.

Prior to the implementation, the dental surgeons at the referral facility received theoretical-practical training covering: characteristics and logistics of the teledentistry project for the SSDR; administrative aspects and registry of activities; systematic taking of clinical photographs; intraoral and extra-oral x-ray techniques; use of equipment and a diagnostic and treatment update of the most prevalent pathologies of the different specialties involved.

The project is beginning in the most geographically isolated communes (Futaleufú, Palena, Chaiten) where it is impractical for patients to attend the referring centre to receive specialised attention.

In addition the Osorno Health Service developed a teledentistry programme oriented to the management of DMA during 2018. This initiative includes children between 4 and 7 years of age with skeletal Class 1 and with DMA, such as crossbites, open bites associated with bad habits, underbites, and others. Those patients who fulfil the referral criteria will be referred from primary to secondary care through remote consultation. An asynchronous platform called Phoenix is used to this end. Once the remote consultation has been received, the specialist analyses the history and determines the appropriateness of a referral. If it is deemed appropriate, the level of priority is determined, guaranteeing the timeliness of the service. According to the complexity of the case, the specialist will be able to indicate preventive or therapeutics actions that the general dentist can perform in the APS through tele-orthodontics or undertake the treatment in the referral centre by the specialist.[15]

Mobile applications
Under the auspices of state-run universities, two mobile applications have been created in the area of dentistry. The first is MIH Molar, developed by the University of Chile. This is an educational application for healthcare students and professionals, the aim of which is to contribute to the early diagnosis, referral (where appropriate) and indication of timely treatment for molar-incisor hypomineralisation (MIH. This app is free in the Google app and App stores.[16]

The second is the Dental Trauma Tracker (DTT). The Universidad de la Frontera, in Temuco, Chile, in conjunction with the University of Melbourne, Australia, created DTT, a mobile application for the epidemiological monitoring of dentoalveolar traumas. The system includes two components, the mobile application designed for general users to report traumatic dental injuries (TDI) and the Internet application used by researchers to administer the data and compile reports on dental traumas to generate epidemiological data. The DTT is compatible with multiple platforms, such as iOS and Android, and has three user profiles (health professional, oral health professionals and

laypeople) for the data input.[17] It is currently in the pilot stage in schools and hospitals in Chile.

Challenges for teledentistry in Chile

It is expected that teledentistry will contribute to meeting the strategic objective of "strengthening dentistry services in the integrated networks by improving the referral and counter-referral for dental specialties" within the framework of the National Oral Health Plan 2018-2030.[4] This policy framework seeks to improve the effectiveness of primary care, improve the appropriateness of and access to dental specialist care, strengthen the teams at the different levels in the delivery of integral services, focused on the person and ensuring continuity of care. As part of this policy framework it is envisaged that teledentistry will increase coverage and access to specialists, improve the appropriateness of referrals for in-person consultations and reduce costs in specialist care.

It is also expected that by 2020, all of the health services will have synchronous and asynchronous consultation systems for the dentistry specialties.[4] In addition, the aim is to increase the dentistry specialties offered and to include others, such as teleradiology and teleTMJD.

Moreover, current government authorities highlight a powerful digital agenda, broadening these strategies and policy initiatives to other aspects of telehealth, including teletraining, tele-assistance, teleprevention and telepromotion in healthcare.

From the digital infrastructure point of view, progress is required in the process of digitising medical data related to diagnoses, examinations and services, for which a unique electronic file is required for both the public and private sectors and a unique Internet platform system to be able to standardise teledentistry processes in Chile.

Finally, one of the main challenges is measuring the impact of the different teledentistry strategies implemented, for which specific indicators and metrics must be generated for each specialty and which will give account of the cost effectiveness of this service modality.

…………………………………………………………………

Corresponding author:
Carlos Zaror Sánchez
Manuel Montt #112
Department of Paediatric Dentistry and Orthodontic
Faculty of Dentistry
Universidad de La Frontera
Temuco, Chile
Tel/Fax: 56-45-325775
E-mail: carlos.zaror@ufrontera.cl

References

1. Instituto Nacional de Estadística (INE). Censos de población y vivienda. Available at: http://www.ine.cl/estadisticas/censos/censos-de-poblacion-y-vivienda accessed 17 December 2018.
2. Becerril-Montekio V, Reyes JD, Manuel A. Sistema de Salud de Chile. *Salud Pública Mex* 2011;53(S2):132-143. https://www.scielosp.org/scielo.php?pid=S0036-36342011000800009&script=sci_arttext&tlng=es.
3. Isapres de Chile. El sistema de Salud Chileno. Orígenes, Transformaciones y Desafíos. 2016. Available at: http://www.isapre.cl/PDF/Informe%20Técnico_El%20Sistema%20de%20Salud%20Chileno.pdf accessed 17 December 2018.
4. MINSAL. Plan nacional de salud bucal 2018-2030. Available at: https://www.minsal.cl/wp-content/uploads/2017/12/Plan-Nacional-Salud-Bucal-2018-2030-Consulta-Pública-20_12_2017.pdf accessed 17 December 2018.
5. MINSAL. Diagnóstico de situación de salud bucal. Available at: https://www.minsal.cl/portal/url/item/7dc33df0bb34ec58e04001011e011c36.pdf accessed 17 December 2018.
6. Diaz JA, Bustos L, Brandt AC, Fernandez BE. Dental injuries among children and adolescents aged 1-15 years attending to public hospital in Temuco, Chile. *Dent Traumatol* 2010;26(3):254-261. DOI: 10.1111/j.1600-9657.2010.00878.x
7. Espinoza G, Muñoz-Millán P, Vergara C, et al. Prevalence of early childhood caries in non-fluoridated rural areas of Chile. *J Oral Res* 2016;5(8): 307-313. DDOI: 10.17126/joralres.2016.064.
8. MINSAL. Programa nacional de Telesalud. Available at: https://www.minsal.cl/wp-content/uploads/2018/03/Programa-Nacional-de-Telesalud.pdf accessed 17 December 2018.
9. MINSAL. Plan e-salud. Available at: http://www.salud-e.cl/plan/contexto/ accessed 17 December 2018.
10. MINSAL-DEIS. Reportes REM 2017-2018. Available at: http://webdeis.minsal.cl/rem2018/ accessed 17 December 2018.
11. MINSAL Lineamientos del uso de telemedicina en referencia y contrareferencia de patología oral. 2017.
12. World Health Organization. WHO eHealth Resolution. Available at: https://www.who.int/healthacademy/news/en/ accessed 4 April 2019.

13. Biblioteca del Congreso Nacional. Available at: https://www.leychile.cl/Consulta/ accessed 17 December 2018.
14. Ministerio de Hacienda. Sistema Público de Salud, Situación actual y proyecciones fiscales 2013-2050. Available at: www.dipres.gob.cl/598/articles-117505_doc_pdf.pdf accessed 17 December 2018.
15. Servicio de Salud Osorno. Protocolo de referencia y contrarreferencia ortodoncia preventiva e interceptiva. Resolución exenta nº9766. 29 November 2019.
16. Universidad de Chile. FOUCh crea App educativa odontológica. Available at: http://www.odontologia.uchile.cl/noticias/129630/fouch-crea-app-educativa-odontologica accessed 17 December 2018.
17. Zaror C, Espinoza-Espinoza G, Atala-Acevedo C, et al. Validation and usability of a mobile phone application for epidemiological surveillance of traumatic dental injuries. *Dent Traumatol* 2019;35:33-40. DOI: https://doi.org/10.1111/edt.12444