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TELEHEALTH IN THE AMAZON REGION IN LATIN AMERICA: AN OVERVIEW

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Abstract

Purpose: This paper describes the current status of telehealth in the Latin American Amazon and displays the result of a distance course on malaria, focused on physicians and healthcare professionals from nine countries of the Amazon region. Methods: Data were collected on telehealth implementation and course participation for the following countries in the Amazon region: Brazil, Colombia, Ecuador, Peru, Venezuela and Bolivia. Results: There are 808 Municipalities in the Amazon region. Over half (51.9%) of the Municipalities have implemented or are implementing telehealth projects in the region. Among these 6 countries, Brazil has the highest percentage of municipalities with telehealth projects implemented (498 of 808, 61,6%;), Venezuela (38 of 91, 41.7%) and following by Bolívia (5 of 39; 12,8%). Participation in the distance course on malaria has included 868 students: Brazil, 291 participants (33.5%); Bolivia, 28 (3.2%); Colombia, 104 (12.0%); Ecuador, 52 (6.0%); Guyana, 2 (0.2%); Paraguay 1 (0.1%), 270 Peru (31,1%); 102 Venezuela (11.8%) and others (2.1%). Nearly all (99.1%) of learners would recommend the course to colleagues. Conclusion: Shared action between countries is an important framework that can lead to incorporation of telehealth resources and training for a common, remote setting, as exemplified by international activities in the Amazon region.

Keywords: Telemedicine; technology enabled learning; international cooperation; Amazonia; public health policy; malaria.

Introduction

The Latin American Amazon region covers 6.9 million km [2] distributed in nine South American countries (Brazil, Bolivia, Peru, Colombia, Ecuador, Venezuela, Guyana, Suriname and French Guiana).[1] Telehealth implementation and use falls short of that achieved in other Latin American regions because of the specific requirements of this isolated and vast region.

Implementation of telehealth activities in Latin America (LA) continues, with significant interaction and exchange of experiences between countries. The Pan American Health Organisation (PAHO), the Economic Commission for Latin America (ECLAC), and the Inter-American Development Bank (IDB) are technical cooperation agencies which have in recent years been supporting innovative projects aimed at the development of telehealth activities.[2,3,4] Several European Community initiatives are also contributing to the development of telehealth activities in and between European and Latin American countries, through projects like EUROsociAL,[5] @LIS Project,[6] and the Seventh Framework Programme (FP7).[7]

In Latin America, countries with more telehealth deployment experience and expertise such as Brazil,[8] México[9] and Colômbia,[10] have at various times served as reference points for the development of telehealth processes in the region. Brazil in particular has made major efforts to contribute to the development of telehealth actions in the Amazon region.

Several telehealth project deployment initiatives in the region were promising from the standpoint of building technology solutions, establishing alternatives to the incorporation of information resources in very adverse settings. As part of the @LISproject of the European Community, two demonstration projects took place in several Latin American countries of the Amazon region. "The EHAs Foundation (Spain)[11,12] in 2001 and 2003, developed an important project in the region that tested different connectivity solutions several Amazonian regions of Peru, Colombia, and Ecuador.". The project highlighted some aspects of the experience of providing quality voice communications to remote and isolated regions using radio data transmission systems (VHF, HF, WiFi, WiMAX). These solutions allowed Internet access and telephony at reasonable costs for implementation, exploitation and development of small-scale pilot projects.

Another project, coordinated by the Institute of Alemanha Franhöfer[13] and also a part of @LIS, sent medical images (X-rays and ultrasound, malaria microscope slides) from Puerto Merizalde and Buenaventura (regions of the Colombian Amazon) to referral hospitals. Problems encountered were: (i) importing the medical devices into the country; (ii) high communications infrastructure costs in the Colombian Pacific coast and (iii) difficult negotiation with health and government entities.

The European Community also participated in a collaborative Project between Colombia and Peru, called Rural Telemedicine Network, in Putumayo River Basin[14] involving Ministries of Health of Colombia and Peru, covering 13 healthcare providers from both countries. Diagnostic capabilities and treatment at border healthcare facilities were improved by deployment of a videoconference teleconsultation system supported by peripheral capabilities including tele-stethoscope, telemicroscopy, and tele-ultrasound. These supported remote management of critically ill patients, and drug control through a centralised system.

In the Brazilian Amazon, in 2005, the University of São Paulo and the State University of Amazonas jointly developed a telehealth project involving training for professionals and teleconsultation in the region of São Gabriel da Cachoeira.[15] The results have been promising and will guide the development process of the actions of the National Telehealth Project in the Amazon region.

Also in Brazil, in 2006, an experience in Madeira River, in Rondônia,[16] included setting up a small centre for telemedicine. The experience promoted the inclusion and participation of local inhabitants of nine riverside communities. The system allowed the simultaneous exchange of audio and video in real time. Another study conducted in Brazil established a telemedicine pilot network in paediatric oncology involving Municipalities in the Amazon region, with positive results.[17] Another project, supported by a medical team, Virtual Medical Team Amazon (AVMT in Portuguese), provided medical support using telemedicine.[18] A study in Colombia demonstrated satisfaction of patients from remote areas with telemedicine.[19]

The cumulative experience of different solutions and clinical/social approaches must have provided huge lessons of value in developing other solutions.These initiatives improved the implementation of larger institutional projects, coordinated by the Ministries of Health or State and City Health Departments. In 2009, PAHO and the Amazon Cooperation Treaty of Organization (OTCA in Portuguese) developed the Project network Pan-Amazon Telehealth. This involved the Ministries of Health of eight countries in the region. Also, in 2010, the IDB started the implementation of the Regional Telehealth Policy Protocols Project for Latin America, which now also includes the Amazon region, because of the importance of the region to Latin America and the impact that telehealth can bring to this area. These activities are coordinated by Brazil.

These two projects are now focusing on the development process of telehealth activities in the Amazon region of Latin America. A review and evaluation of telehealth implementation and development activities informed future approaches. For example, there was consensus to use existing telehealth resources in the region (identified in the review) for a training course on malaria. This paper describes the review of telehealth in the Latin American Amazon and presents the result of a distance course on malaria, focused on physicians and healthcare professionals from the nine countries of the Amazon region.

Methods

Initially, the health ministries of the eight countries of the Amazon region appointed a person responsible for national coordination of telehealth, or a similar body, in each country. Of the eight countries (Bolivia, Brazil, Colombia, Ecuador Guyana, Peru, Suriname, Venezuela and French Guyana), French Guyana did not send representation. The national telehealth coordinators, together with universities in LA countries, have standardised a common survey instrument for reporting telehealth activities in the Amazon region. The instrument focuses primarily on the existence of infrastructure for the development of telehealth actions or planned actions of telehealth implementation by government projects.

National coordinators sent the survey to be completed by the persons responsible for the Amazon region's provinces or municipalities, depending on the country. The responses were subsequently consolidated by the General Coordination Committee, a Division of the Brazilian National Telehealth Program Committee.

Each country selected a representative to participate in the result analysis and discuss development strategies for telehealth actions for the region. Data were systematised, after standardisation of concepts in relation to the municipalities and provinces, since each country works with different units.

Given the existence of a telehealth infrastructure in the region, a distance training course on malaria was established, aimed at medical doctors and health professionals. The topic was chosen by the representatives of the region, and was developed by different specialists in malaria from several countries of LA. The classes included the use of 3D modelling. Tutors were selected and trained, the course was run between May and August, 2014, and the results analysed.

Results

There are 1,253 municipalities in the Amazon region, excluding Suriname, Guyana and French Guiana, which did not respond, with 808 (64%) in Brazil (Table 1).

Table 1. Development of telehealth activities in the Amazon region by country.

	Municipalities	Telemedicine		
		Developing Services	Existing Services	No Services (%)
Bolivia	39	34	5	0
Brazil	808	22	498	288 (35.6)
Columbia	69	21	0	48 (69.5)
Ecuador	6	0	3	3 (50.0)
Peru	240	16	0	224 (93.9)
Venezuela	91	0	38	53 (58.3)
Total	**1253**	**93**	**544**	**616 (49.2)**

National telehealth projects effectively implemented in the Amazon region are still mostly incomplete, except for Bolivia. Currently, the Ministry of Health of Bolivia has made an effort to implement its national telehealth project, starting its activities also in the Amazon region, with plans to reach all of the municipalities by 2016.

Brazil has most municipalities with telemedicine services or planned services. Venezuela and Ecuador are in a telehealth resources incorporation process in their Amazon region. Colombia and Peru have started some telehealth activities in the region.

Overall, 43,4% of municipalities in the Amazon region have implemented telehealth projects, but there are projects that, if implemented by governments as planned, will cover 50.8% of the municipalities in region. Consequently there is still a long way to go in the region regarding the implementation of telehealth projects.

Analysis of the telehealth situation in Amazon region of Latin America by Country

Brazil
The Brazilian Amazon covers 4.2 million km^2 (49% of the country) distributed in nine states (Amazonas, Pará, Mato Grosso, Acre, Rondônia, Roraima, Amapá, Tocantins and part of the Maranhão) across 808 municipalities. The implementation of telehealth projects in the region is seen as a priority in the National Telehealth Project, comprising two phases - a pilot phase in which telehealth resources were implemented in only one state in the region - the State of Amazonas, which structured telehealth resources in its university centre and 62 municipalities. Thereafter the State of Tocantins received funds to implement telehealth services which it has currently deployed in 69 of its municipalities. In these states, municipalities are already working with telehealth, developing teleconsultation, webconferencing, and distance learning activities.

As part of the expansion phase of the National Telehealth Project, the other states in the Amazon region, Acre, Amapá, Roraima, Rondonia, Para, Maranhão and Mato Grosso, received funds to structure technical-scientific telehealth centres, starting in 2013. Currently, 62% of the municipalities in the Amazon region are already part of the National Telehealth Network.

Bolivia
Bolivia is located in the central area of South America. Its territorial extension is 1,098,581 km^2, having borders to the north and east with Brazil to the south with Argentina, to the west with Peru, and to the Southeast with Paraguay and Southwest with Chile. The Bolivian Amazon region represents 44.7% of the country, divided into three states: Santa Cruz, Beni, and Pando, with populations of 302,936, 430,049 and 75,335, respectively.

Bolivia started the implementation of its National Telehealth Project in late 2014 with an ambitious vision, and with great incorporation of telehealth technologies. The latest technology equipment (such as digital general examination cameras, digital ophthalmoscopes, vital signs' monitors, electrocardiograms, ultrasounds, digital videocolposcopy equipment), were installed in each medical centre connected to the Telehealth Program with connectivity via a Bolivian satellite.

Three regions were prioritised for the initial process of implementation of the national project, including the Amazon region - the province of Santa Cruz, which has already deployed its telehealth points and is in full operation. The perspective is that by the end of 2016 all Bolivian municipalities, including the Amazon region, will have their telehealth project implemented.

Peru
Peru's Amazon region encompasses three states (Dalton Del Maranon, Upper Amazon, and Maynas), totalling 240 municipalities. Peru designed its National Telehealth Project in 2006, but telehealth initiatives were fragmented. Only in 2014, with the regulatory framework, has the National Telehealth Project been implemented. In its Amazon region, only 16 municipalities have telehealth capabilities, some bordering with Peru. The main focus of this project is teleconsultation and training activities.

Venezuela

Venezuela is still in the process of formulating a National Telehealth Project, but there are some telehealth initiatives promoted by the federal government in its place. Connectivity of the Amazon facilities is part of the policy of the National Telecommunications Plan implemented by the Ministry of Science and Technology through the National Telephone Company of Venezuela, largely through the Satellite Simon Bolivar, and is also part of the project announced by the Ministry of Health to strengthen the primary care level. These are national public sector projects.

The health facilities currently connected are located in the three Venezuelan states of Amazonas, Bolivar, and Delta. Most of these are primary care facilities, with infrastructure for teleconsultations and webconferences. In Puerto Ayacucho, capital of Amazonas state, a Training Room and Virtual Triage service has been established to support education and teleconsultations of staff located in areas of difficult access. Despite some difficulties, there is already some telehealth infrastructure deployed in 41% of the Venezuelan Amazon region.

Colombia

In Colombia, the Amazon region is composed of five provinces: Amazonas, Caquetá, Guainía, Guaviare, and Meta. Colombia has had a National Telehealth Project since 2006, which aims to improve health conditions of the entire Colombian population, especially those living in remote places. It focuses on teleconsultation.

It the province of Caquetá efforts have focused on enabling telehealth projects in the Amazon region and 13 of the 16 municipalities in the region are using telehealth resources. In Meta province, the governor allocated resources for installation and operation of health services in the form of telemedicine in the 29 municipalities, for which a satellite system has been used since 2009.

In the Peru-Colombia border region, the European Community co-financed the bi-national project "Rural Telemedicine Network in the Putumayo River Basin", on the waterfront of the Putumayo River in both countries. This involves the Department of Loreto, Putumayo Districts, and Lieutenant Manuel Clavero in Peru, plus the Department of Amazonas, Villages of El Encanto and Putumayo Department, and the Municipality of Puerto Leguizamo in Colombia. This project provided necessary equipment, connectivity, and training to staff working in these institutions.

Ecuador

Ecuador has a National Telehealth Project whose goal is to bring specialised medical consultation services through teleconsultations to all corners of the country, and to equally extend continuing education services to health workers. Implementation has been slow. Its Amazon region has six provinces: Sucumbios, Napo, Orellana, Pastaza, Morona Santiago, and Zamora Chinchipe. The Ecuadorian National Telemedicine / Telehealth Program has developed its pilot plans in three of them, Pastaza, Morona Santiago, and Napo, which have undergone major infrastructure improvements, including within the national connectivity programs, and structural wiring. This has been cause of slow implementation of the project.

Telehealth units have been planned for primary health facilities as well as at three provincial, secondary and tertiary hospitals, Hospital Provincial de Tena, Puyo Provincial Hospital, and Provincial Hospital Macas. Infrastructure, cabling, equipment and staff training of the team responsible for provincial telemedicine has been completed. They are able to use the telehealth resources, but use is still low.

The current National Telehealth and Telemedicine Program is part of the National Plan for "well live" and contributes to strengthening the care model through telemedicine tools which process is ongoing.

It was not possible to collect structured information of telehealth activities from Guyana, Suriname, or French Guiana, which compared to the other countries, occupy a small area of the Amazon region of Latin America.

Analysis of distance learning for professionals on malaria in the Amazon region

The course was structured as 10 pre-recorded classes divided into three modules using resources that involve 3D modelling, graphic animation, videos and textbooks. However, the course was provided with on-line activities or alternatively the evaluation activities may be downloaded and sent back later on. The three modules were: the aetiology and physiology of malaria; epidemiology concepts; and clinical features, diagnosis and treatment of malaria, with a total workload of 80 hours. It was conducted in Portuguese and Spanish, with students of both languages interacting in the forums and webconferences. It was staffed by a co-ordinator, two sub-coordinators, 11 general tutors (three content tutors and nine medical monitors). The course was conducted between May and September 2014. The certifying institutions are the Federal University of Minas Gerais (UFMG), State University of Amazonas (UEA), Fiocruz with the support of the Pan American Health Organization (PAHO).

A total of 868 health professionals from eight countries in Latin America enrolled for the course. Participants were from Brazil 291 (33.5%), Bolivia 28 (3.2%), Colombia 104 (12.0%), Ecuador 52 (6.0%), Guiana 2 (0.2%), Paraguay 1 (0.1%), 270 Peru (31,1%), Venezuela 102 (11.8%) and others 18 (2.2%). Nearly one-half (48.6%) had a Masters degree, 46% had higher education without a degree, and 4.1% had education at the intermediate level. Medical graduates accounted for 38% of learners, nursing 20%, and 45% from other areas. Over half of the learners (54%) had no previous experience in participating in distance courses. Of the 884 enrolled learners, 774 began the course (~87%), 10% of the applicants never took the lessons, 36% did not complete all modules, and 64% completed the programme.

There were no statistically significant differences in the distribution of learners by gender (57% female) or marital status (married 42%). The predominant age group was between 26-30 years (22%) and 31-35 years (22%). Most of them had up to 5 years' experience after graduation (42%), followed by students with 5-10 years' experience (20%), 11-15 years (14%), and 24% with over 16 years experience.

When analysing of the responses related to general evaluation of the course (n = 481), 68.4% of learners evaluated the course as excellent or 'great'; 28.8% evaluated it as good; 2.5% as fair, and two did not respond. As for the content assessment 69.4% of the students evaluated the content as excellent or 'great'; 28.5% as good, 1.5% fair, and 0.6% did not respond. When asked if students would recommend the course to other colleagues 99.1% said yes.

Discussion

In all the countries surveyed, there are already several institutional initiatives incorporating telehealth resources, which if implemented, could cover more than 51% of the Municipalities in the Amazon region. In other words the entire region already structured, or being structured, with a set of telehealth resources. They are all nationally endorsed. Several authors point out difficulties in implementation and use of telehealth resources in developing [20,21] and calculations suggest that only about 0.1% of the potential telemedicine demand from the Developing World is being met.[22] ECLAC[23] in its guidelines for the development of telehealth in Latin America stresses the importance of telehealth projects and making up a set of policies of intensifying penalty if underused and not achieving the expected results.

WHO in its analysis of telehealth in low-income countries highlighted the difficulty of implementing actions using resources already in place, and the low incorporation of technology.[24] With the exception of Bolivia, the projects being implemented in the Amazon region of Latin America have low technology input. Despite limitations, it is relatively surprising that there are already planned telehealth activities for more than half of the Amazon region. Several authors from Latin America reinforce this [25-27] For a country of continental dimensions such as Brazil, the formation and consolidation of collaborative networks to support healthcare at a distance is of strategic importance to the reduction of costs for the Unified Health System (SUS), and the improvement of quality of healthcare in remote areas of the country. Telemedicine tools improve the quality of care, support health and even monitor the endemic diseases, aggregating benefits with the creation of the Amazon Telemedicine Service. In Peru, health services often require the opinion of experts who are in many cases hundreds of kilometres away, and ICT can contribute to improving coverage and quality, benefiting especially the most vulnerable sectors. In Colombia the results are already beginning to show impacts in the areas of primary and semi-intensive care. Telehealth as part of the healthcare system in all its components: management, regulation, civil and criminal responsibilities, services, connectivity).

However, the difficulties are significant for the Amazon region,[28] involving connectivity, structuring of health services, and turnover of professionals. The distance learning course on malaria shows that, despite the precariousness of the telehealth structure in the Amazon region, it is possible to provide courses using complex learning resources, provided you have the flexibility to accommodate participants with different connectivity options and capability.[29,30] The success of the course indicates that participants (learners and experts) from different countries, speaking different languages (Spanish and Portuguese) can co-exist on the same course, and also suggests it will be possible to scale courses up even when experts from different countries are brought together to produce distance learning courses.

One of the major limitations of this study relates to the difficulty of standardisation of concepts and terms which are each used in different ways by different countries, provinces, towns, and villages, which may affect the results of the telehealth service coverage, as well as lack of data on three countries of the region.

The development of telehealth actions in the region is ongoing and highlights the value of joint efforts to ensure that existing potentials are maximised.

Conclusion

Health policies for the Amazon region of Latin America incorporate the use of telehealth and infrastructure. Already plans exist for implementing telehealth projects and resources are being provided within a large proportion of the regions countries. Currently telehealth has been implemented in about 50% of the Amazon region of Latin America. It should be noted that Brazil, because of its size and the number of Municipalities involved, skews the results as the country is already a little more advanced in the implementation process of telehealth activities in the Amazon region.

The implementation experience of the course of malaria aimed at healthcare professionals from all nine Amazon-related countries showed that, with existing resources, a shared use is possible between countries, with promising results.

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