BRAZILIAN TELEMEDICINE NETWORKS

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Abstract: One of the outcomes of the telemedicine evolution was the emergence of telemedicine networks which can be characterized as the interconnection of centres or healthcare professionals to provide telemedicine services. This paper aims to present a study of the characteristics of the Brazilian telemedicine networks. For the implementation of this study and the selection of the projects, the authors proceeded a search and revision of articles and sites obtained in the Google and PubMed repositories. As conclusion, the existence of two types of networks was verified: infra-structure and telemedicine service; all of the networks are based on asynchronous telemedicine, most of them acting in inter-cities, nevertheless there are not telemedicine cases inside the own municipal district to eliminate socioeconomic barriers; there were not find inside these networks projects or initiatives to regulate the remuneration of the professionals involved in the processes as well as, the payment for the services that were used.

1 INTRODUCTION

Telemedicine is defined as the offer of services related to health care, as well as the changing of information in cases where the distance is a critical factor (Neira, 2006). These services are provided by health professionals, using information and communication technologies for exchanging valid information for diagnoses, and for the health care providers continuous education, as well as, for research and evaluations purposes.

Actions in telemedicine are being done in Brazil since the 90's decade, and although the efforts demonstrate exciting potential results and the great medical centers possess plenty of advanced hospital units, it persists a growing demand for medical care in remote places, executed by skilled professionals and, in this way, initiatives and projects appeared in telemedicine (Rede Nacional de Ensino e Pesquisa, 2006).

Among these projects we can observe the telemedicine networks implementation which can be characterized as the interconnection of health professionals, universities, diagnoses centers, libraries, hospitals, as well as government entities. These networks intend to eliminate the physical and social barriers to the healthcare services. Their objectives are (Anderson, 2006): 1) improve access to the specialists' services; 2) allow the patients' attendance minimizing displacements; 3) improve teaching and updating in medicine and health.

The objective of this article is to present a study and analysis of the characteristics of the Brazilian telemedicine networks.

2 MATERIALS AND METHODS

To start this work, first of all we collected information from Annals of Brazilian Health Informatics Congresses from 2006. As well as, we have collected more information by contacting local authorities, national administration and other informal sources of information, like websites, newspaper and magazines.

For this formal study we have selected telemedicine network projects considering papers by systematic review from PubMed (PubMed Central, 2007) and systematic search in Google (Google, 2007). With the objective to use the specific descriptors for the searches above, first it was done a review on DeCS - Health Sciences Descriptors (Descritores em Ciências da Saúde, 2007) – a Latin

American version of MeSH – to identify keywords for the search. Only the term *telemedicina* (telemedicine) was found. Although we didn't find a representing term for telemedicine networks, the following terms were adopted for this research: *rede telemedicina* (telemedicine network) and *rede telemedicina Brasil* (telemedicine network Brazil). Then, on February 2007, we searched on Google (Google, 2007) - with the web option selected - and on PubMed (PubMed Central, 2007) repositories using the identified terms described above.

2.1 Search and Inclusion Criteria

The first 20 summaries results of selected the repositories were analyzed. When the summary presented information about a Brazilian telemedicine network, the article was considered for this study. Just the articles that had objectives and goals about Brazilian telemedicine networks were added to this review. In those cases where article made reference to a new telemedicine network that wasn't found previously it was made a new specific search. We search that new network on same repositories proceeding to verify the 10 first results following the same criteria of the main search.

Due to the lack of telemedicine networks information standardization, without any condition to determine similar points of comparison, these criteria were established.

3 RESULTS

The telemedicine networks found based on the established criteria were eight. Following the results:

3.1 Academic Network of Telemedicine – *Rede Universitária de Telemedicina* (RUTE)

The RUTE objectives include to support the improvement of existent telemedicine projects in university hospitals and to motivate the arising of futures inter-institutions works (Rede Universitária de Telemedicina, 2007).

The initiative intends to create the use of advanced network services to promote the arising of new applications and tools that explore innovative mechanisms for the education in health, for distance cooperation in pre-diagnosis and for the remote evaluation of medical service data. (Santos, 2007).

3.2 Catarinense's Telemedicine Network Project - *Rede Catarinense de Telemedicina* (RCTM)

It consists of an infrastructure for distributing digital diagnosis services. Its objectives are to be used as sample for the formulation of a new technological model and standards that can be used by institutions of public health in other states of Brazil.

The project includes all of the functionalities of the assistance telemedicine, integrating on a single on-line platform the acquisition of data or images of exams, the dispatch of results, the request of patient internment and the decisions to be taken. (The Cyclops Group, Rede Catarinense de Telemedicina, 2007) (Sociedade Brasileira de Informática em Saúde, 2007).

3.3 Medical Digital Station - *Estação Digital Médica* (EDM)

The project links hospitals, universities, and other institutions through the telecommunications, informatics and other technological solutions.

The EDM objectives include fomenting the practice of medical care and education in distance at Brazil, optimizing the health system. Its actions, among others, include programs of professional improvement, technical training, information and prevention, second specialized medical opinion, clinical discussions (Estação Digital Médica, 2007).

3.4 ONCONET

The ONCONET includes a network of universities, and research medical institutions. It consists of a system developed in a client-server model using open software tools.

The ONCONET objective consists in supporting the medical practice in pediatric oncology. This project presents the electronic patient records for child cancer, distance education, and the data mining and statistics quantifications (Yuuji, 2005). It began its operations in 2004. Today it has 30 hospitals affiliated to the Brazilian Society of Pediatric Oncology (SOBOPE - *Sociedade Brasileira de Oncologia Pediátrica*).

3.5 HEALTHNET

HealthNet is a telemedicine application that interconnects institutions between São Paulo and Recife. More specifically, it gives support to the remote diagnosis and to the second medical opinion.

It is a project from NUTES (NUTES - Núcleo de Telessaúde, 2007).

Its objectives includes to improve the health services for distant and lacking areas, as well as to allow implanting a medical cooperation process among great specialist centers. (Rede Nacional de Ensino e Pesquisa, 2007).

3.6 Telemedicine Brazilian System - *Sistema Brasileiro de Telemedicina* (SBTM)

The SBTM objectives are to include all the functionalities of the assistance telemedicine in a unique on-line platform. It involves the creation of a national model of telemedicine with the definition of a Brazilian standardization for the section and the construction and refining a group of software technologies model for the implantation of a public network of telemedicine (The Cyclops Group, Sistema Brasileiro de Telemedicina – SBTM, 2007).

3.7 T@LEMED

This network intends to demonstrate the supply of telemedicine services in critical areas of Colombia and Brazil. The implementation of this e-health model is based on modern technologies of remote health as well as on medicine based on evidences. (Sachpazidis, 2006; Santos, 2007).

3.8 BH-Telessaúde (BHT)

Its goal consists in developing a low cost project that solves two problems on the Unique System of Health (SUS - *Sistema Único de Saúde*): physicians and other professionals precarious formation and the visible choke of the secondary attention. The network is implanted in 76 basic health units (UBS – *Unidade Básica de Saúde*), and focuses in the primary attention, by offering assistance support through second opinion, consultancy and discussion of clinical cases, besides activities of permanent education (Santos, 2007).

In order to facilitate the observation and the analysis of the results of this study, Table 1 was generated. In this way, it can be seen which networks practice distance education, which practice the asynchronous telemedicine, among other characteristics. The identified items with an 'X' indicate that the network has such characteristic; those identified with '?' mean that there was not found any information about the characteristic; the

lack of any identification type means that the network does not have such characteristic.

Terms used in Table 1: *Distance Education* - the telemedicine network provides the remote education for the health professionals involved. *Implanted and Operating* - the telemedicine network is firmly established. *Asynchronous Telemedicine* – type of telemedicine that not occurs in real time. That means that the response for a request of health care occurs later without synchronicity (Wootton, 2006). *Synchronous Telemedicine* – type of telemedicine that occurs in real time. That means that the entities involved in the process need to be online at the same time, with synchronicity (Wootton, 2006). *Inter-cities* – the telemedicine process occurs between different cities. *Telemedicine Service* - systems and processes that promote telemedicine services. *Infra-structure Network* - physical structures (equipments and communication resources) that allow and facilitate the use of telemedicine.

4 CONCLUSIONS

Analyzing the data presented on Table 1, it is verified the existence of two types of networks: infra-structure and telemedicine service. The first one can be characterized just by network infra-structure that allow and facilitate the use of telemedicine. This infra-structure is represented as LAN (Local Area Network) or WAN (Wide Area Network) equipments and communication resources. The second one can be characterized by systems and processes that promote telemedicine services and may come in computational systems format or as an agreement between institutions. Normally, the service networks runs over the network infra-structure. It's possible to verify that most of the Brazilian networks do the service type.

It can be observed that all of the networks use the asynchronous telemedicine and only four of them use the synchronous form. This difference may be justified due to the low cost and the easiness of use that the asynchronous telemedicine proportionate (Wootton, 2006). For example, there is no need to schedule its use and its participants do not need to be online at the same time.

The majority of the networks act in inter-cities. However there are few cases of telemedicine inside the own municipal district to eliminate socioeconomic barriers and/or to provide safety to the health professionals, for example, in the

Table 1: Main characteristics of the Brazilian telemedicine networks.

Characteristic	RUTE	RCTM	EDM	ONCONET	HEALTHNET	SBTM	T@LEMED	BHT
Distance Education	X		X	X	X	?	-	X
Implanted and Operating		X		X	X	-	X	X
Asynchronous Telemedicine	X	X	X	X	X	X	X	X
Synchronous Telemedicine	X	X	X	-	X	?	X	X
Inter-cities	X	X	X	X	X	X	X	X
Telemedicine Service	X	X	X	X	X	X	X	X
Infra-structure Network	X	X	-	-	-	-	-	-

penitentiary health care. The majority part of Brazilians perceives a 2440 dollars/year salary and don't have sufficient financial resources to pay the transportation to specialized medical centers.

Finally, there were not find inside these networks any project or initiative to regulate the remuneration of the professionals involved in the processes as well as, the payment for the services that were used. Those points are important because of professionals financial resources needs and it always exists costs of maintenance of equipments and systems. The outcome could be disinterest and discontinuity of services that aim to improve the people's health and of their communities. The cost-effectiveness of any of the eight telemedicine solutions was not found.

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