The National Telehealth Program in Brazil: an instrument of support for primary health care

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Abstract

This article aims to present the National Telehealth Program, which is being implemented in Brazil. This program relies on telehealth resources with the objective of carrying out teleconsultations and permanent education. It makes use of 3D modeling, animations, and videos that encompass 900 Brazilian municipalities. The program is directed at the Family Health Teams (ESF) with the objective of contributing to the consolidation of the model of care that focuses on a Family Health Program (PSF). In addition, it includes actions focused on the medical, nursing and dental teams. This article clearly outlines not only the distinct and expected results of the program but also the manner in which the program is organized and managed. In addition, the article discusses the various possibilities for structuring the project in nine state centers. The preliminary results are presented and illustrate the progressive incorporation of telehealth resources in the daily lives of the teams working with family health in the country. Currently, the project can be found in more than 600 cities throughout the country and distributed in nine Brazilian states.

Key Words: Telehealth; Telemedicine; Remote Consultation; Primary Health Care; Family Health; Distance Education.

Resumen

El programa nacional de telesalud en Brasil: un instrumento de apoyo a la atención primaria

Este artículo tiene como objetivo presentar el Programa Nacional de Telessalud llevado a cabo en Brasil, con la incorporación de los recursos destinados a telessalud, para realización de las teleconsultas y la educación continuada en 900 ayuntamientos brasileños. Se utilizan recursos de modelado 3D, animación y vídeos. El programa está dirigido a los Equipos de Salud de la Familia (ESF), pretendiendo contribuir en la consolidación del modelo de atención centrado en lo Programa Salud de la Familia (PSF), incluyendo acciones dirigidas a los equipos de medicina, enfermería y odontología. Se describen en detalle los diferentes productos, su forma de organización y gestión, además de las diversas posibilidades para la estructuración del proyecto en los nueve centros de estado. Los resultados preliminares se presentan, con la incorporación progresiva de los recursos de telessalud en el diário de los equipos de salud de la familia en el país. Actualmente, el proyecto está implantado en más de 600 ayuntamientos en el país, repartidos en nueve estados brasileños

Palabras Clave: Telesalud; Telemedicina; Consulta Remota; Atención Primaria de Salud; Salud de la Familia; Educación a Distancia.

Resumo

O programa nacional de telessaúde no Brasil: um instrumento de apoio à atenção primária

Este artigo se propõe a apresentar o Programa Nacional de Telessaúde que está sendo implantado no Brasil, com incorporação de recursos de telessaúde objetivando a realização de teleconsultorias e de educação permanente, abrangendo 900 municípios brasileiros. São utilizados recursos de modelagem 3D, animações e vídeos. O programa está dirigido para as Equipes de Saúde da Família (ESF), objetivando contribuir para a consolidação do modelo de atenção centrado no Programa Saúde da Família (PSF), englobando ações dirigidas para os médicos, equipes de enfermagem e odontologia. São descritos de forma detalhada os distintos produtos esperados, sua forma de organização e gestão, além das diversas possibilidades de estruturação do projeto nos nove pólos estaduais. Os resultados preliminares são apresentados, demonstrando a progressiva incorporação de recursos de telessaúde no cotidiano de equipes de saúde da família no país. Atualmente, o projeto encontra-se implantado em mais de 600 municípios do país, dispersos em nove estados brasileiros.

Palavras-chave: Telessaúde; Telemedicina; Consulta Remota; Atenção Primária à Saúde; Saúde da Família; Educação a Distância.

INTRODUCTION

Brazil is a country of continental proportions that can be characterized by socio-economic and cultural contrasts, a heterogeneous distribution of infrastructure, and differences with regard to the level of qualifications of professionals. These factors, along with geographical challenges, lead to variations in the quality of health services throughout the country's different regions.

The history of health care in Brazil has changed since the implementation of the Family Health Program (PSF). The Ministry of Health has been steadily perfecting the PSF and expanding its coverage. This fact can be easily verified by observing the evolution of federal spending on these programs, the number of personnel involved, and the number of people covered by these services. The Family Health strategy is currently being employed in about 84% of Brazil's municipalities, through the work of approximately 29 thousand health teams.

Experiences in various countries, including Brazil, have shown that investments in Primary Health Care (APS) and their extension to activities, which involve the training of family health professionals and the community, have led to significant improvements in health care systems, both from the point of view of individual and collective health and in terms of the expansion and improvement of the quality of health support. In addition to increasing the success of the health services provided, the emphasis on primary care has had an important impact on health system costs.

Macinko[1] showed that a 10% increase in PSF coverage is associated with a 4.5% reduction in the infant mortality rate. This finding is supported by a recent study conducted by the Brazilian Ministry of Health that illustrated how the expansion of the PSF is associated with a drop in Infant Mortality rates (from 22.4% in 1998 to 18.8% in 2003) and a drop in Infantile Post-Neonatal Mortality (9.2 in 1998 to 6.5 in 2003). The study also points to other benefits that are independent of social-economic levels. During this same period, there was an increase in vaccination coverage (from 39% to 64%) as well as positive results with regard to maternal breastfeeding.[2]

The Brazilian Public Health System (SUS) follows a logic that relies upon the predominant use of ambulatory care. Interestingly enough, this has received the greatest attention in programs that have tried to optimize resources allocated to health care. International agencies are reaching the conclusion that the ambulatory foundation should be focused on APS and, therefore, (1) provide easy access, (2) a complete and longitudinal approach to care, and (3) a coordinated understanding of how users make use of the system. In this sense, APS offers a more cost-effective resolution. Studies on Family Health strategy in Brazil point to a large increase in the percentage of the population with access to the system. Nonetheless, there are still serious problems, especially in the North region of the country, that also include insufficient development of support for Primary Care.

One of the main obstacles to the expansion and perfection of the quality of the Family Health strategy, which is now being detected, relates to the training of the team's professionals so that they may be qualified for working according to the proposed model. The curriculum and the pedagogical model, in effect at most health courses, still have not made the necessary changes to comply with the National Curricular Guidelines or are at the early stages of doing so.[3,4,5]

A Secretariat for Management of Work and Education in Health (SGTES) was created in 2003 within the regimental structure of the Ministry of Health. It can be regarded as a result of both the Sanitation Reform Movement, which is active since the 1970s, and the intention of complying with article 200 of the Federal Constitution ratified in 1988. Accordingly, it makes the SUS responsible for the formation of human resources for health. It consists of two departments: the Department of Management and Regulation of Labor in Health Care (DEGERTS) and the Department of Management of Education in Health care (DEGES). It should be noted that these advancements denoted a change in perspective with regard to how questions related to work and education in health care should be articulated.

DEGERTS has operated with the intention of giving more value to health care worker by promoting actions that improve precarious work conditions and establishing a National Negotiating Table between management and labor in the SUS. It has also worked on drafting a proposal for a law to establish principles and guidelines for job descriptions, career plans and salary levels for SUS workers that would be applicable to both state and municipal levels.

The structural bases for educational policies in the health care area, implemented by DEGES, promote the integration of educational institutions and health care services. This occurs so that the educational training process of professionals can address not only the true health needs of the Brazilian population, in accordance with the principles and guidelines of the SUS, but also meet the long-term educational requirements of health care work-

ers. This includes actions that are directed at changing current practices and work processes, according to the needs that stem from the services.

In addition, various actions promoted by the SGTES are being developed. These involve support for changes to undergraduate programs, which are aimed at implementing the National Health Care Curriculum Guidelines and training of faculty. They are developed through coordinated actions that have been formalized in the Inter-ministerial Decree nº 2.118[6], establishing technical cooperation between the Ministry of Health and the Ministry of Education. These actions articulate the formation and development of human resources in health, which both start at the technical/undergraduate level and extend to graduate and post-graduate levels, involve the educational training of faculty, and the establishment of research in health.

One of the main actions within the environment of this partnership is the National Program for the Restructuring of the Educational Training Process of Health Care Professionals, Pro-Health (*Pro-Saúde*). This program began in November 2005 with a selection process set to decide which projects for undergraduate courses in health would be chosen. In the first phase, 90 courses in Nursing, Medicine and Dentistry were chosen. The World Health Organization (WHO), through the World Health Report, and the World Federation of Medical Education mention Pro-Health as the most courageous example of linking education and health underway in the world today.

While on one hand SGTES has been acting to promote changes in the educational training of future health care professionals, by changing undergraduate programs, it has also worked to train workers who are already employed and who were educated in the traditional fragmented, biology-based, disease-centered educational model. SGTES' technical cooperation and political-institutional and financial support have been directed at medical and multi-professional residencies, as well as at the duplication of successful models in specializations, particularly related to family and community health, through the Multicentered Network of Support for Specialization in Family and Community Health.

The Telehealth Program in support of Primary Care is being developed as a structural initiative of DEGES/SGTES in partnership with the Primary Care Department of the Secretary of Health Care (DAB/SAS). It also seeks to support the educational and qualification process that occurs with the teams working in Family Health. The goal is that, along with other initiatives focusing in the same direction,

this will result in the possibility of offering health professional more favorable conditions so that they remain in remote locations with difficult access. This would be done as these professionals find themselves in less isolated situations due to the establishment of communication with Telehealth Services located at various universities. The SUS is currently burdened with high costs for Treatment Outside the Home (TFD) due to the cost of transporting patients. In addition to the issue of costs, many times the patient's serious condition makes transportation a risk to the patient's life. The continual difficulty on bringing specialists to these remote locations and keeping them there is a challenge that can be structurally faced by telehealth. Greater resolution rates and a reduction in costs is expected, given the fact that a second opinion through teleconsultation helps solve simpler problems and eliminates the often unnecessary and costly use of more sophisticated technologies.

Many questions still have to be answered, such as difficulties with referrals to specialists (waiting lines, cost of transportation and room, geographical barriers, the lack of a system for references and cross-references between primary care, and services demanding medium and high levels of complexity), the need for a second opinion for specialized or rare clinical cases, the need for the development of human resources, and the need for establishing continuing education for professionals in light of the challenge of seeking to improve working conditions in health care according to the SUS principles.

The constant evolution of scientific knowledge has made professional training a continuous process for maintaining the quality of services. The adequate training of professionals should be looked at as a strategy that will increase the efficiency of health care services. This is because educational improvements will lower costs associated with care by allowing for the reduction of wasteful actions and by diminishing the consequences of inadequate conduct and procedures.

Many professional training programs offered in Brazil have met limited success. Among the various factors that have contributed to this result are: the use of inefficient pedagogies, an insufficient number of instructors for the implementation of an ample and continuing program, difficulties in travel for professionals (geographic distances), and the incompatibility between work hours and hours for training. These problems may be partially avoided by broadening the diffusion of educational systems supported by the use of technologies (interactive e-learning) that are developed at the research centers of Brazilian universities.

The drop in hardware and telecommunications costs and the development of software in the area have both paved the way for new solutions adapted to problems that may arise in service. The WHO, United Nations Education Scientific and Cultural Organization (UNESCO), and the International Telecommunications Union (ITU) have dedicated themselves to the study of this potential.

Telehealth should be viewed as a national strategic action which, in addition to optimizing health care, allows for the rationalization of available resources, making it easier for the government to act quickly. It is in this particular context that we are looking for the contribution that telehealth can make to APS in Brazil. We hope that by using APS, we can bring the resolution rate for the health system close to the 85% which is experienced and defended internationally.

Thus, actions and investments, utilizing telehealth resources, may represent a strategic action that allow for the creation of teaching-care units for APS, and so facing one of the system's greatest challenges: overcoming the isolation and the distance that separates the professionals that work in the PSF, given the fact that the units are far removed from each other and have a restricted number of professionals. This situation is a contrast with what happens at teaching/university hospitals or large ambulatory centers that bring a great number of specialists and health professionals together under the same roof, facilitating the teaching-learning process.

The creation of quality virtual support that is able to provide education and second opinions to health teams would contribute to increasing the capacity of the system to successfully solve cases. Along with an ample set of actions related to the management of labor and the training of health professionals, telehealth appears to be one alternative, among the tools that are available, that could have a favorable impact on the capacity of the SUS to solve cases. Another benefit of telehealth is the possibility of creating an environment for epidemiological monitoring using structures created for tele-education and telecare. This would permit strategic national planning in the health area for the control of endemics and epidemics.

For telehealth actions to have sustainability in the long run, other support actions must be developed. In March 2006, in an unprecedented action in Brazil, the Ministry of Health created a Permanent Telehealth Commission under the authority of the Secretariat for Management of Labor and Education in Health. In an attempt to avoid the non-use of infrastructures and to optimize the use of resources, the Commission brings together various Ministries, federal government, agencies, representatives from universities with experience in telemedicine and telehealth, and interested entities (Federal Councils) to share knowledge and plan a cooperative strategy for the implementation and development of telehealth in Brazil.

The objective of this article is to present the Telehealth Program in support of Primary Care coordinated by the Ministry of Health.

OBJECTIVES

General Objectives

The general objective is to improve the quality of basic care services offered by the SUS by using technology to expand the qualification process of Family Health Teams. It intends to do so in order to promote e-learning and telehealth, which, in turn, would have a positive impact on the successful solution of cases at the primary care level and in the general health of the population.

Specific Objectives

- Assemble the information and telecommunications technology infrastructure for the continuous development of the professionals of the Family Health Teams at a distance through the use of multimedia (virtual library, videoconferencing, on-site and virtual skills, public television channels, video streaming and chats).
- Form a network of institutions for the collaborative development of materials for interactive tele-education.
- Systematize the tele-education process in health care (training, practical qualification and evaluation of professional skills.)
- Development of training programs in the areas of medicine, dentistry, and nursing.
- Create laboratories using simulation mannequins for skill training.
- Structure a system for educational consulting and second opinions among specialists, higher education institutions and primary care professionals by utilizing the offline and online telehealth resources.
- Promote digital inclusion of APS professionals (training professionals to use telehealth as a strategic complement to care and continuing education.)

- Implement a logistical strategy that would optimize public health system costs through greater resolution levels at basic care, decrease the number of cases forwarded to the secondary and tertiary levels, and/or emergency units, and organization of requests for complementary tests.
- Provide ample access to a network of reliable sources of information in primary health care in order to subsidize clinical decision-making processes, education and management in the area.
- Promote integration between the professionals of the Family Health teams and health system managers at the municipal, state and federal levels.
- Promote integration between the academic sector and the primary health care level.
- Assemble new telehealth centers at institutions and university hospitals in every state participating in the second phase of the project.

RELEVANCE OF THE PROJECT

This project goes beyond the simple action of creating a technological infrastructure for telemedicine and telehealth in order to integrate national institutions. It is a multi-institutional (involving the federal, state, municipal levels and universities/academic arenas) articulated project that seeks to create a program for primary care training and care support in diverse regions, leading to both an improvement in the quality of health and the development of actions with a greater social impact. The primary strategy involves the sharing of knowledge among diverse centers of excellence at universities and the application of that knowledge in the PSF with the purpose of improving training of PSF professionals at their working place and deceasing rotation. The effective implementation of the project may also generate benefits in the control of endemics and epidemics.

The integration of institutions, with complementary areas of excellence in science and education, can lead to the improvement of the educational quality with a reduction of costs. This occurs because it will facilitate the sharing of educational and care content. Each center will develop its area of excellence and share its knowledge with other institutions.

Even though the first phase of the project (pilot project) only involves nine universities, those identified as having accumulated experience in telemedicine and telehealth in

Brazil, incentives for the establishment of telehealth infrastructure are planned for every state in the country so that they may participate in the second phase of the project. Each university will function as a Telehealth Center and will initially be connected to one hundred points located in the Primary Care Units of the PSF.

Telehealth today is a powerful instrument that offers a wide variety of distance training programs and specialized care. It is a science that employs modern information technology and telecommunications to create tools that can be used nationally as a strategic resource for optimizing the health system.

Relying upon second opinions, through established centers, seems to be a tendency that will, in itself, become more popular as the universalization of telecommunications becomes more widespread and digital inclusion increases. However, this project focuses on the Educational Second Opinion, which can be considered a mixed approach that combines care and education. It is a project that trains professionals in accordance with their day-to-day problems based on an educational academic structure. In essence, it is the equivalent of a complementary educational internship and "in loco" practice focusing on regional problems.

The availability of an ambulatory environment, based on web/Internet and other lines, will enable the expansion and use of telehealth even in the most remote regions of the country. The inclusion of decision-making and therapeutic, diagnostic and management materials help to improve the quality of care to the population and promote continuous professional education.

Considering that Brazil is a federation, telehealth activities must respect the autonomy of each federated unit or state in the country. The institutions responsible for each state are connected through a rapid system that will allow for the development of flexible interrelations when necessary. Each center, for its part, provides support to the cities in its state. It does so through the use of telemedicine/telehealth with broad coverage, generating universal care with the appropriate technology according to the needs presented.

Interactive Tele-education presents the best alternative for integrating the diverse teams in the PSF and providing teaching material. This should not be understood as merely distance learning. It should be seen as a process that associates optimization of methods and a complete environment that brings together technologies for increasing educational ability, not only through conventional means, but

also through distance courses. Interactive tele-education can use mixed methods (partly distance and partly on-site), according to the public in mind and the subject matters and qualification process that will be developed.

Interactive tele-education does not only depend on technology, given the fact that the quality of the program is enhanced with the use of pedagogical resources. One example is the Virtual Man Project that belongs to the study of Learning Objects in Health at the University of São Paulo (USP) School of Medicine. This is a powerful tool that uses 3D computer graphics as an aid to student's learning. It helps students grasp certain complex ideas more easily, such as anatomical aspects and their functional correlation, physiology and physiopathology in disease, among others. The Virtual Man can complement educational tools, becoming a part of clinical-surgical demonstration videos. In addition, it can help make a learning object to become more concrete to a student in the context of an educational program

The great advantage of the use of interactive tele-education is that the best educational programs can be replicated without a loss in quality. In the long run, it also reduces costs. The sustainability of the initiative is easily supported by the savings it brings.

CHARACTERISTICS OF THE PROJECT

General Coordination

The Brazilian Ministry of Health through the Secretariat for Management of Labor and Education in Health (SGTES) and the Health Care Secretariat (SAS).

Institutions of Higher Learning responsible for the Telehealth Centers:
- State of Amazonas – State University of Amazonas (UEA), Federal University of Amazonas (UFAM)
- State of Ceará – Federal University of Ceará (UFC)
- State of Goiás – Federal University of Goiás (UFGO).
- State of Minas Gerais – Federal University of Minas Gerais (UFMG)
- State of Pernambuco – Federal University of Pernambuco (UFGO).
- State of Rio Grande do Sul – Federal University of Rio Grande do Sul (UFRGS) and Conceição Hospital (GHC).
- State of Santa Catarina – Federal University of Santa Catarina (UFSC)

- State of Rio de Janeiro – State University of Rio de Janeiro (UERJ).
- State of São Paulo – University of São Paulo (USP)

Non-university Institutions
- BIREME (Panamerican Health Organization – OPAS)
- Oswaldo Cruz Foundation (Fiocruz)

Partner Ministries in the Telehealth Program in support of Primary Health Care
- Ministry of Education (Secretariat of Distance Education / TV-School)
- Ministry of Science and Technology (National Network of Teaching and Research – RNP / University Telemedicine Network - RUTE)
- Ministry of Communication (GESAC)
- Ministry of Defense
- Civil Office (System for the Protection of Amazônia – SIPAM)

CHARACTERISTICS OF TELE-EDUCATION

In this project, the training and update of programs for professionals are being developed with the use of telematics. While tele-education has already significantly evolved, a good educational model should include four aspects in order for it to have an educational impact. These include training in practical skills, evaluation of competency, specialized second opinion and evaluation of change in practice.

In addition to the aspects listed above, basic literature must be made available to the public in mind, providing them with the opportunity for basing their decisions on the best evidence available. In the same manner, the potential for improving the quality of care will be greatly increased with the possibility of interaction and sharing of tests and small–sized research that reveal solutions to real problems within the scenario of the APS.

The themes that will be addressed cover the areas of interest of the professionals who work in the Family Health Program:
- Doctor – Continuing Medical Education Program
- Nurse – Continuing Education Program for Nursing
- Dentist – Continuing Education Program for Dentistry
- Nursing Technician
- Dental Hygiene Technician
- Dental Office Assistant
- Community Health Agent

Modules for the Telematics environment

EDUCATIONAL SECOND OPINION (ON DEMAND)

This activity is a complement to the educational training process. Each session lasts for an average of thirty minutes. It includes a discussion of the problem forwarded by the requesting group in an academic format. This activity helps professionals to adapt their skills according to the necessities presented in their region. In addition, it helps the institutions, which are responsible for the project to recognize the characteristics of their PSF teams and the difficulties they face. This can also become an important source of strategic data for evaluation by the Ministry of Health.

CONTEXTUALIZED COURSES

These are courses that address specific subjects in an objective manner. The main characteristics of these courses are their interactivity and personalization (a possibility for individualized educational monitoring for each student). Theoretical knowledge will be tested by multiple choice questions which allow for commentaries, contextualized texts and simulated situations (evaluation of logic and conduct). The courses will have 20% of their class hours on-site for training of practical skills. These classes will include the use of mannequins in order to carry out practical training.

LEARNING OBJECTS

The learning will focus on two components: (a) knowledge, based on videos that make use of computer graphics (the Virtual Man Project) and (b) the clinical-behavioral aspect, based on sequences of videos from clinical practice. These components help improve educational effectiveness through the stimulation of associative memory.

EVALUATION OF SKILLS

This is an important aspect for measuring how much knowledge was acquired and the skills and changes in attitude of the professionals of primary care. It is also a moment for evaluating the impact that this will have on the quality of care.

VIRTUAL LIBRARY IN PRIMARY HEALTH CARE (BVS PRIMARY CARE)

This is a network of information sources based on experiences related to primary care that seek to help in the processes of (1) clinical decision-making and (2) the educational training and administration of Family Health Teams, professionals of the Second Opinion, and participants in the project.

VIRTUAL COMMUNITIES

This includes the collaboration and sharing of experiences and locally-produced knowledge, which is made available through evaluation by APS specialists and in a structured way.

Coverage area expansion

In order to expand the areas covered by the project, joint actions are being promoted together with:

- TV-School which uses the infrastructure of MEC Educational TV to transmit the Contextualized Courses. This transmission can use the free time slots within TV-School programming.
- GESAC which includes the interaction over the web at 2,500 points installed in MEC schools and 400 Ministry of Defense points. This will eventually allow others to take advantage of the telehealth centers already installed.
- System for the Protection of Legal Amazon (SIPAM)
- The National Network for Teaching and Research (RNP), based in the Ministry of Science and Technology, includes connection to the University Telemedicine Network (RUTE), which is the interconnection to the teaching institutions connected by the network of university hospitals that make up RUTE.
- InfoSUS Network (available in almost all capital cities in Brazil.)
- Fiocruz Health Channel.
- Network already contracted locally.

EXPECTED RESULTS

- The structuring of a logistical health network consisting of nine interconnected centers (the project higher education institutions – phase I) with a high-speed transmission network, which would include video-conferencing for development of cooperative actions connected online.
- Definition of low-cost programming solutions (Internet-based Telemedicine/Telehealth) for distribution to remote points in the country.
- Implementation of a system for synchronizing educational databases hosted on different servers.
- Installation and implementation of computational

resources for the health care area, which would be used as support for Internet-based second opinion.

- Development of methods for making tele-propae-deutics feasible.

- Development, systematization and distribution of two hundred programs for professional continuing education programs developed by the participating centers.

- Distribution of educational material based on video streaming through multi-centered videoconference debates.

- Installation and implementation of computational resources for the Interactive tele-education area, which would be used as support for promoting Internet-based education with practical demonstrations and on-site skills training.

- The training of teaching groups and technicians for the development of technology-based educational material and use of new tools for promoting distance education.

- The training of health professionals and workers in the use of technological resources installed at remote points. Low-cost telemedicine resources (forwarding of cases for second opinion) and distance education.

- Development of training and continuing education courses at a distance. This would be in line with the principal causes for network searches related to primary care and with health problems that can be handled in priority primary care by SUS administrators.

- Expansion of the infrastructure for the development of the Virtual Man Project and preparation of twenty programs designed with the intention of providing orientation for the prevention of disease in the Brazilian population, supported by sequences in the Virtual Man Project.

- Implementation of software for monitoring and providing early warnings with regard to troubling health conditions in the population (epidemiological monitoring) in the Cyberambulatory system.

- Development of support software for the support, the control and the monitoring of infections related to health care.

- The training of dedicated specialists so that they understand the scenario and principles related to primary care, with the intention of optimizing the exchange of second opinions.

- The structuring of a communications strategy group that would prepare motivational educa-tional material for professionals other than medical doctors, such as students, among others; and the development of strategies for stimulating the general media involvement in communicating to the public useful information and those questions related to prevention.

Once the Telehealth Program applied to primary care has been implemented and its impact has been evaluated, its philosophy, principles, and operational structure may certainly be applied to other national health policy priorities.

## PRELIMINARY RESULTS OF THE BRAZILIAN NATIONAL TELEHEALTH PROGRAM

Various activities involving the incorporation of telehealth resources by the Family Health Teams are already in the process of becoming routine. The table below demonstrates that, by the end of 2008, the program was already implemented in 660 of the 900 municipalities, which were included in the initial planning. As shown in Graph 1, nine Brazilian states are involved. As a result, 2,960 Family Health Teams are benefiting from the program's efforts to provide these municipalities with connectivity. In addition, efforts were made to emphasize the implementation of the National Telehealth Program in remote areas, particularly in municipalities connected to the centers in Amazonas and Pernambuco.

The activities carried out by municipalities related to the process of incorporating telehealth resources into the health care system and establishing continuing education activities are both a part of the objectives initially called for by the project.

Teleconsultation activities are performed online and offline in the national telehealth program in Brazil. With online teleconsultations, the members of the family health teams, who are in the benefited municipalities, request a teleconsultation and, through a process of pre-scheduling, the clinical cases are discussed. With offline teleconsultations, questions are sent to the teleconsultants who answer back to the professional. This generally occurs through systems especially developed for this purpose. Several centers have already developed such systems. The data on teleconsultations performed in the context of this National Telehealth project are detailed in Graph 2.
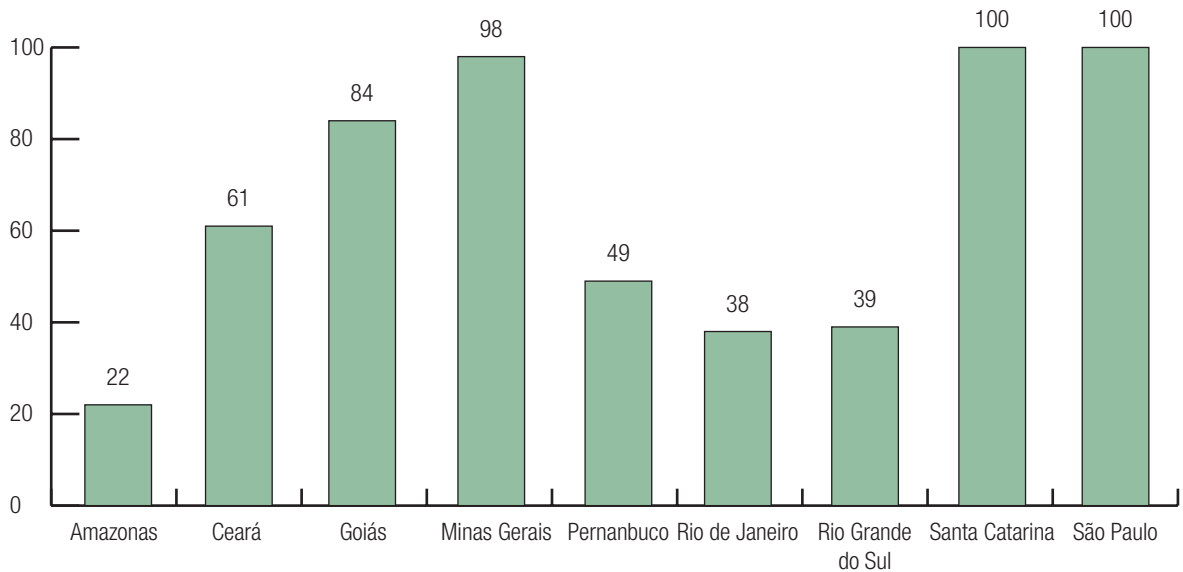
Graph 1 - Distribution of the number of municipalities participating per state.
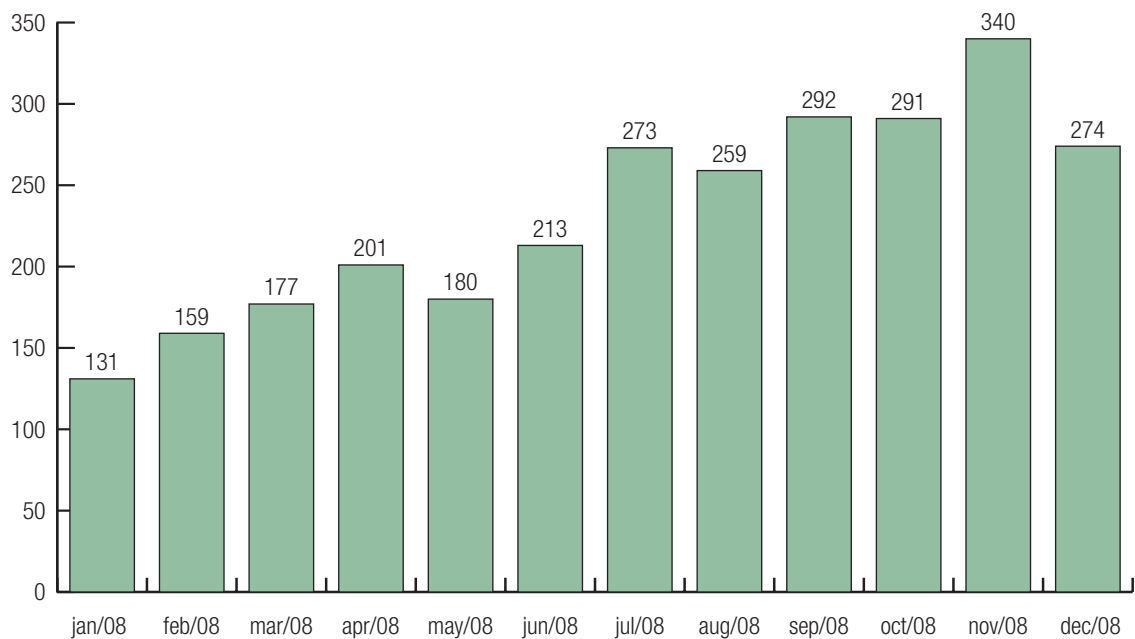
Graph 2 - Monthly distribution of teleconsultations performed online and offline.

The experiences involving the performance of teleconsultations within the National Telehealth Program are structured differently according to the state involved. In some states, the specialists are the ones who respond to the teleconsultations of the Family Health Teams. In others, the answers are forwarded after discussion between family health doctors or professionals with specific training in the primary care area. These professionals look for scientific evidence in primary care relevant to the doubts raised by the teams, by relying on bibliographic references. Questions are only forwarded to specialists when they determine that there is truly a need for the opinion of a specialist.

This process has great educational potential, as it leads to a process of educational training in primary care with a high level of added value. The telehealth centers in the states of Rio Grande do Sul and Rio de Janeiro have operated in this manner with highly promising results.

In the health care area, activities related to propaedeutic tests have also been carried out. These activities are currently concentrated in the centers of Minas Gerais, Ceará and Amazonas. In these centers, the municipalities that make up the national program receive a digital electrocardiograph. Afterwards they structure the process of forwarding the electrocardiograms to a cardiology center where professors, then issue reports and discuss patient's clinical cases when there is evidence of cases with serious pathologies that may pose an immediate threat to the patient's life. The Graph 3 presents the results of this activity during the year 2008.
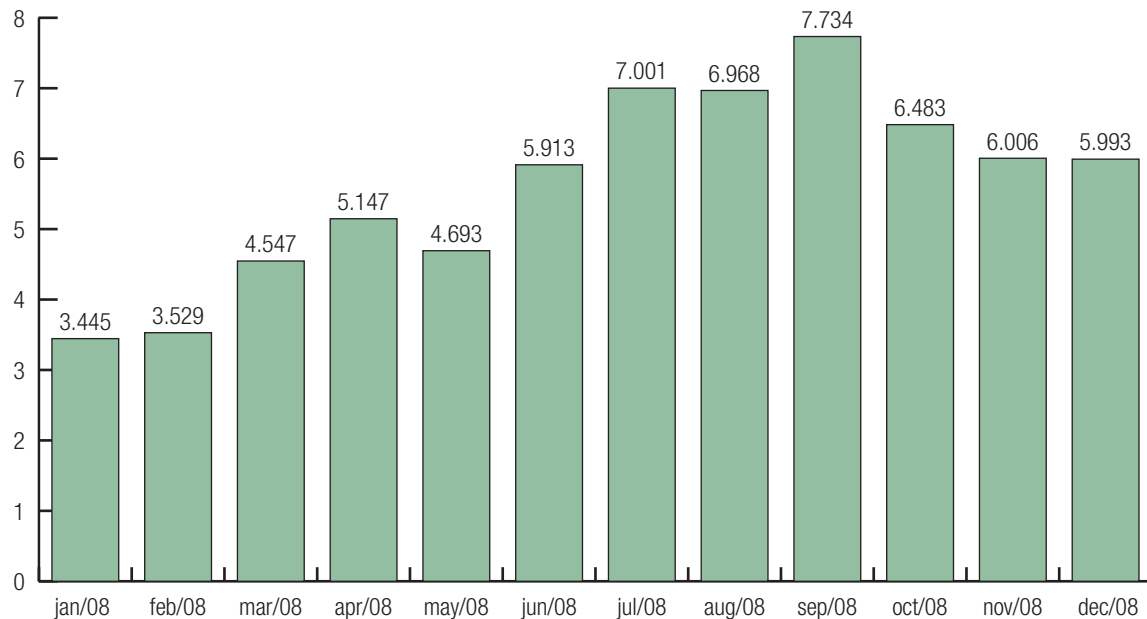
In the telehealth center of the National Telehealth Program in the State of Goiás, there is a process for the performance of activities referring to another propaedeutic test – retinography. This teleophthalmology project, in which digital retinography are performed with equipment that captures images without the need for dilating patient's pupil, allows one to track the major causes of blindness.

This system identifies early cases of cataracts, glaucoma, diabetic retinopathy and macular degeneration related to aging, with the development of the "Program for Detection of Prevalent Causes of Blindness through Teleophthalmology."

Another important aspect of the National Telehealth Program concerns the educational training process for Family Health Teams. The centers for São Paulo and Minas Gerais were initially responsible for the process of producing content and aggregating distinct telehealth resources for the educational process. These included the construction of virtual learning objects, the structuring of distance courses utilizing organic 3D modeling, animation and interactive videos, and the customizing of platforms for distance education.

The use of 3D modeling of organic structures became a priority due to the fact that it enables the construction of virtual learning objects that are capable of simulating physiological, pathological, and anatomical events simultaneously and dynamically. This technique creates perfect articulation between organic objects and the use of resources such as images, sound and video. These processes are possible not only because of the acquisition of 3D models of human anatomy, which have segmented systems or models for all of the systems, including male and female anatomy, but also because of the specific development of models.

The models are designed and constructed with quadrilateral polygons and Edgeloops modeling, allowing for a clean surface when the model is subdivided. This means that there are no holes, no stretching of the surface, or texture deformities. They were prepared to be seen in a video as if they were close-ups from a camera within the human body.

Graph 3 - Monthly distribution of support tests performed in the National Telehealth Program.

This resource enables one to focus on specific areas within human organs, with a high quality image for transmission of content that is as close as possible to medical reality.

With regard to the quality of the these models and the images they produce, these models have a technical quality (type of modeling used in their creation) so that the use of 3D illumination can be conceived as creating volume and nuances, which enables the use of a variety of colors.

In order for this process to become reality, laboratories for the production of content were established along with the structuring of the production process for 3D modeling. Other software was also acquired including: specific hardware, software for the incorporation of resources such as video and animation, and platforms for distance education which could possibly incorporate these dimensions. Additionally, teams of professionals with various skills were brought together, including professionals from the fine arts, systems analysts, professionals in video production, anatomy experts and specialists in various areas. Methodologies for the preparation of courses and the construction of virtual learning objects and their pedagogical foundations were also defined.

Currently, the National Telehealth Program includes content that has already been structured and made available to the nine national telehealth centers. These centers rely on modern 3D, animations and video techniques, distance courses, and virtual learning objects. The program also includes another forty-nine courses that have been structured.

DISTANCE COURSES UTILIZING 3D MODELING

Course on arterial hypertension

Measurement of systolic arterial blood pressure; Definition, Classification and epidemiology; Physiopathology; Diagnosis and Staging; Hypertension and Co-morbidities; Treatment of Hypertension; Nursing Consultation; Warnings in Dentistry Care.

Electrocardiography course

Basic Principles of ECG; Electrocardiograph Readings; normal ECG (Complementary Material to on-site class); Atrial and Ventricular Overloads; Ischemic Syndromes I; Ischemic Syndromes II; Supra-ventricular Tachycardia with Narrow QRS; Tachycardia with Enlarged QRS; Bradyarrythmia.

Superficial trauma course

Introduction and Concept of Lesions and Superficial Traumas; Classification of Superficial Traumas; General Principles for Treatment of Traumas and Superficial Lesions; General Prophylaxis of Infections and Tetanus; Approach and Care for most common Superficial Lesions; Technique for Stitches and Small Ambulatory Surgical Procedures; Main Dangers involved in the Treatment of Superficial Traumatic Lesions.

Emergency in the family health care environment

Basic life support and use of an automatic external defibrillator; Classification of risk and urgency network; Airways and principles of ventilation (oxygen systems and use of a ventilation unit); Initial approach to Respiratory Insufficiency (asthma, grave pneumonia, apnea in children); Initial approach to Shock (septic, anaphylactic and cardiogenic); Treatment of Cardio-respiratory failure with advanced life support; Primary Care for Poly-traumatized Patients (including Cranial-encephalic trauma-CET); Transportation and principles of pre-hospital care; Metabolic disturbances (hypo and hyperglycemic, acute thyroid disturbances, DHE, acid-base disturbances); Coronary Syndromes and disturbances of cardiac rhythm; Accidents with poisonous animals and exogenous intoxications); Neurological Emergencies (stroke, convulsive crisis, CET, coma, and others.)

VIRTUAL LEARNING OBJECTS

- Virtual Ear
- Voice: phono-audiology and medicine
- Hormonal contraception method
- Physiopathology of diabetes
- Physiopathology of arteriosclerosis
- Physiopathology of asthma
- Chronic obstructive pulmonary disease (COPD)
- Normal system of locomotion
- Inferior limb amputation
- Female genital-urinary tract
- Menstrual cycle
- Temporomandibular joint
- Dental structures
- Abdominal organs: male genital-urinary tract; male urogenital anatomy

- Anatomy of the neck and techniques for cricothyrotomy and intubation: maintenance of the upper airways and trauma of the thorax
- Dynamic musculature of the face
- Acne and skin restoration: physiopathology of acne
- Skin cycles
- Protection and hydration of the skin
- Physiopathology and transmission of Hansen's disease
- Photo protection and skin cancer

In addition to this production of content, the National Telehealth Program also prepared videoconferences with subjects chosen by professionals. This would enable professionals, at their own job locations, to interact with Teachers in the areas of medicine, nursing, and dentistry. The practice involves the use of webconferencing tools that create virtual classroom systems. These settings concomitantly make use of the resources such as voice, video, data and graphics, in an environment structured for group learning with the following characteristics: integrated audio and video conferences; integrated chat text – public and private; feedback tools - polls, yes/no, raising of hands, applause; shared applications; interactive blackboard; web browsing; closed classrooms and research and testing tools. Various tools were evaluated by the national telehealth program center at Santa Catarina, which opted for systematizing the potential and the problems of solutions that already existed on the market. Consequently, each center would adopt the best alternative according to their evaluation. The Graph 4 presents the e-learning activities that occurred within the environment of the National Telehealth Program, including courses and lectures.

The use of videoconferences is routine at the majority of the centers. These videoconferences generally occur twice a month and in each one of the areas – medicine, nursing and dentistry. The table below shows the number of people of tele-education activities.

Another important aspect of the National Telehealth Program concerns the structuring of the Brazil Telehealth portal, which was created and is administered by BIREME. The portal is a network of information sources based on facts related to primary care. It is designed to assist in clini-
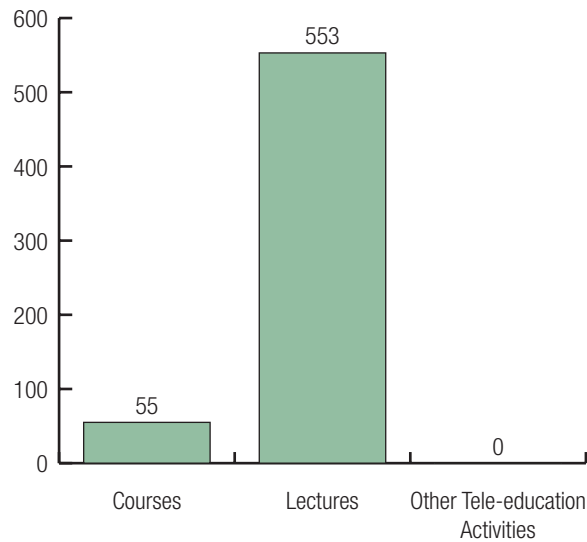
Graph 4 - Distribution of tele-education activities in the National Telehealth Program.
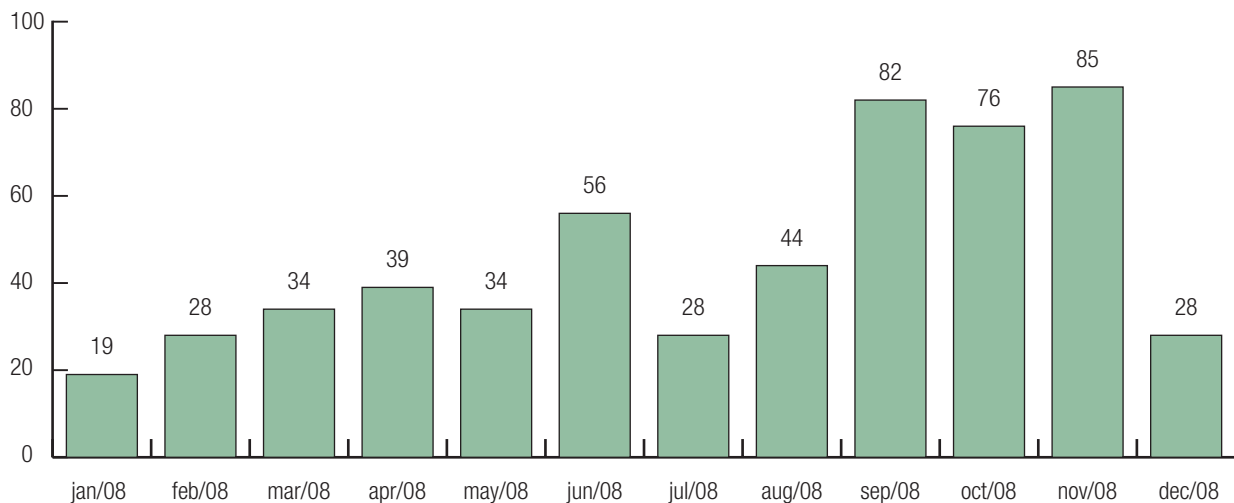
Graph 5 - Monthly distribution of the number of tele-education activities (lectures) in the National Telehealth Program

cal decision-making and the educational training and administration of Family Health Teams, Second Opinion professionals, and project participants.

This data demonstrates that the Brazilian National Telehealth Program is well into the process of being structured and of being fully operational, with a relevant set of activities in both the health care and educational areas. In a country with continental dimensions like Brazil, the process of implementing a National Telehealth Program has been characterized by flexibility and collegial coordination. It seeks to achieve various goals, which would, in turn, transform telehealth into an effective instrument for the process of training Family Health Teams.

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