Improving patient access to specialized health care: the Telehealth Network of Minas Gerais, Brazil

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Abstracts in العربية, 中文, Français, Русский and Español at the end of each article.

Introduction

Brazil is a vast country of marked cultural, economic, geographic and infrastructural contrasts. It is composed of 27 federative units: 26 states and one federal district that contains the capital, Brasilia. Although the Brazilian Constitution guarantees universal and equitable access to high-quality health care, these contrasts make such access difficult to provide. Primary care is central to Brazil’s public health system, which aims to provide comprehensive health care, specialized services and hospital care, as well as health promotion and disease prevention activities. Minas Gerais, a large state, has 19 million inhabitants unevenly distributed among 853 municipalities and is characterized by inequities in health care.

Problem

Residents of small and remote municipalities have difficulty accessing specialized care because health resources are concentrated in the largest cities. Health professionals in remote areas tend to be young and inexperienced and are often isolated and in need of further training. The resulting high turnover rates in the primary care workforce compromise service quality.

Approach

In 2005, the State Government of Minas Gerais, Brazil, funded the establishment of the Telehealth Network, designed to connect the teaching hospitals of five public universities with municipal health departments. This, plus the small amount invested in linking primary care with other levels of care and the failure to provide good access to diagnostic tests, prevents the Brazilian primary health-care model from fully meeting its objectives.

Telehealth, or the use of information technologies in the health professions to provide care, impart education or conduct research, has the potential to reduce existing health-care inequities by supporting primary care professionals in remote areas. Telehealth offers an effective means of improving communication between primary care practitioners and specialists in reference centres, facilitating access to diagnostic tests and enhancing health care quality in under-served communities. However, little information is available with respect to cost-effectiveness, access to services, process of care and user satisfaction in connection with telehealth.

Programme development

In 2005, the State Government of Minas Gerais, Brazil, funded the establishment of the Telehealth Network, designed to connect the teaching hospitals of five public universities with municipal health departments. The health department
of the state initially implemented the programme as a research project in 82 municipalities with fewer than 10 500 inhabitants. Because cardiovascular diseases are the leading cause of death in Minas Gerais and remote areas have a serious shortage of cardiologists, the state health department decided to focus the project on telecardiology [Minas Telecardio Project], specifically on tele-electrocardiography (i.e. the use of the internet to send electrocardiograms [EKGs] from remote areas to university hospitals for interpretation). The project proved feasible and financially sound,8,9 and satisfaction among physicians working in remote locations increased markedly.9,10

After 2007, the Telehealth Network of Minas Gerais began providing teleconsultations also. In other words, primary-care professionals began using the network’s web site to address questions to university staff in areas such as medicine, nursing, dentistry, physiotherapy, nutrition, pharmacy, psychology and audiology. Primary-care professionals can thus perform their clinical activities with the support of a network of specialists on duty in the universities. The specialist who first answers the teleconsultation can seek the help of a subspecialist if s/he considers it necessary. This service is viewed as an ongoing educational tool, since every teleconsultation represents a learning experience. The network was progressively expanded and had reached 608 municipalities by August 2010.

The Telehealth Network relies on low-cost technical equipment easily accessible to poor villages: computers, printers, digital electrocardiographs, digital cameras (e.g. for photographing skin lesions), webcams and low-bandwidth internet. All teleconsultations take place among health-care professionals, since Brazil’s Board of Physicians [Conselho Federal de Medicina] does not authorize teleconsultations between physicians and patients.

A methodology for implementing and maintaining the network was developed. Staff visited all cities in the network and regional meetings with municipal health-care practitioners were held periodically in the municipalities or university hospitals to discuss the benefits of telehealth, the barriers to its implementation (e.g. lack of political support, poor user acceptance, or health-care practitioners’ lack of familiarity with teleconsultation and tele-electrocardiography) and ways to overcome them (e.g. community involvement, training of health-care practitioners in the use of teleconsultation and tele-electrocardiography, and adaptation of local work routines to accommodate use of the telehealth system). These meetings were also attended by the Telehealth Network’s clinical staff, whose members gave lectures on topics chosen in accordance with the questions most frequently asked during teleconsultations. The meetings provided an opportunity for users and clinical staff to develop a comfortable relationship with one another.

To ensure the quality of decentralized clinical services, a quality control office was established and charged with implementing standard protocols, providing an auditing system and promoting clinical research. Auditing consisted of assessing agreement between different cardiologists’ EKG readings. In January 2011, a sample of 905 EKGs was randomly and blindly selected, and every EKG was read by a second network cardiologist, also randomly selected. This cardiologist was not told that the EKG s/he was reading had already been interpreted. Subsequently, a senior cardiologist from Minas Gerais’ teaching hospital [Hospital das Clínicas da Universidade Federal de Minas Gerais] with strong expertise in reading EKGs assessed agreement between the two previous examining and his readings provided the “gold standard”.

User satisfaction was constantly monitored by the system by means of the following questions, which were sent to users after they received the response to their teleconsultation: (1) “Did the teleconsultation avoid the patient’s referral?” (2) “Did the teleconsultation answer your question?” (3) “What is your level of satisfaction with the teleconsultation system?” The first question explores activity efficiency, defined as the number of patient referrals avoided divided by the total number of telehealth activities. The second question gauges the response given by the specialist to the teleconsultations. The third question assesses users’ general satisfaction with the system. From January to October 2011, 13 828 teleconsultations were performed and 1284 users responded to the survey.

Cost-effective analyses were conducted and the following economic indicators were developed: implementation cost per site, unitary activity cost (i.e. cost per activity) and patient referral cost (i.e. cost per referral). Implementation costs were broken down into travel and equipment. The unitary activity cost ($C\textsubscript{a}$) was the total operational cost of the system divided by the number of activities. The patient referral cost ($C\textsubscript{p}$) comprised fixed costs (infrastructure maintenance) and variable costs. Data on the first two indicators were collected from the network management system. Patient referral costs were investigated during visits conducted from August 2009 to August 2011 in 86 municipalities within the Telehealth Network. Since telehealth cannot eliminate all referrals and since expenditure is affected, in turn, by activity efficiency ($E\textsubscript{p}$), the savings to the health system ($S$) can be calculated as follows:

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S = N\textsubscript{a} \times E\textsubscript{p} (C\textsubscript{a} - C\textsubscript{p})
\]

where $N\textsubscript{a}$ is the number of activities. All costs were converted to United States dollars (US$) (at the August 2011 exchange rate of 1.80 Brazilian reais per US$).

**Results**

The network covers around 9 265 820 inhabitants of Minas Gerais, or 47.2% of the population of the state. From June 2006 to December 2011, 825 349 EKGs and 33 042 teleconsultations were performed. This is equivalent to a daily average of 1450 remote EKGs and 77 teleconsultations (Fig. 1) and to an annual average of 540 EKGs and 30 teleconsultations per municipality. The Telehealth Network has now become an essential component of the health-care system in those municipalities.

The majority of teleconsultations were performed offline, and the specialties most in demand were internal medicine, dermatology and nursing. The most frequent types of questions pertained to pharmacological treatment and disease aetiology. Approximately 6000 health professionals have been trained through the Telehealth Network. Presently, the service engages 42 technical and administrative staff, 36 health professionals on duty and 43 specialists,
Telehealth requires a collaborative network of educational and research institutions, government, technology providers and funders to achieve its full potential. To be successful, a telehealth service must meet the real needs of local health professionals, use simple and low-cost technology and have some face-to-face components (e.g. personal visits to the municipalities, workshops and training sessions). Telehealth must use technology as a means for delivering health-care benefits; to be economically beneficial, it must be applied to address problems for which there is a high service demand.

Auditing showed a 9.4% rate of disagreement with respect to EKG abnormalities that were substantial enough to potentially alter case management. Discordant opinions were discussed between the clinical coordinator and the cardiologists to establish protocols based on standard guidelines for EKG analysis and a structured format for reporting.

The satisfaction survey showed that 80.8% of the teleconsultations had averted a referral (i.e. 80.8% activity efficiency), whereas the average telehealth activity cost amounted to US$ 6.03. For a total of 759,656 activities, an activity efficiency of 80.8% and a variable referral cost of US$ 40.18 per referral, the telehealth system generated a saving for the public health system of US$ 20,081,840 between June 2006 and October 2011. An investment of US$ 9,000,000 was required to obtain this benefit. Hence, the cost–benefit ratio was 2.24 to 1.

The economic analysis showed that travel costs were reduced from an average of US$ 2,240 per site in the programme’s 82 original municipalities to US$ 305 per site in the 328 municipalities that joined the network in 2009–2010. Equipment costs remained approximately constant at US$ 2,500 per site, on average, during all phases of network expansion. The average cost per patient referral was US$ 63.60 (US$ 23.42 fixed cost and US$ 40.18 variable cost), whereas the average telehealth activity cost amounted to US$ 6.03. For a total of 759,656 activities, an activity efficiency of 80.8% and a variable referral cost of US$ 40.18 per referral, the telehealth system generated a saving for the public health system of US$ 20,081,840 between June 2006 and October 2011. An investment of US$ 9,000,000 was required to obtain this benefit. Hence, the cost–benefit ratio was 2.24 to 1.

**Discussion**

In this paper we have described the development of a large, public, state-wide telehealth system that supports primary care professionals in remote regions of the Brazilian state of Minas Gerais as part of a government strategy to fulfil the constitutional premise of universal access to high-quality health care. Combining assistance and in-service education with simple and inexpensive technology, the telehealth model has been shown to be effective, technically feasible and economically viable. To the best of our knowledge, this telehealth project is one of the most successful to have been described in the scientific literature until now.

The valuable lessons learnt in the course of conducting our study are listed in **Box 1**. In **Box 2** we offer recommendations for implementing a successful telehealth programme based on our experience with the Telehealth Network of Minas Gerais, although some are contained in other guidelines. Initially network implementation and maintenance were difficult; the Internet connection was poor at the beginning of the project and health-care practitioners had to be trained continually because of the high turnover in the workforce in remote municipalities. Furthermore, in the Brazilian public health system, telehealth activities are not reimbursable. Hence, the programme’s funding is always dependent on specific health department budgets. A stable source of funding will be essential for the sustainability of the telehealth programme.

This report has limitations. Although we have demonstrated that primary care physicians look favourably upon the Telehealth Network, we did not evaluate whether the programme reduced the high turnover rate among these professionals. Moreover, we did
not evaluate the impact of the telehealth programme on the health status of the population and are therefore unable to say whether the programme has prolonged patients’ lives or improved their health. Both of these questions require future study.

Conclusion

A telehealth programme developed to support primary care professionals in Minas Gerais, Brazil, has produced good results overall at relatively little cost. Initially conceived as a research project, it developed into a state-wide public health strategy covering hundreds of municipalities and thousands of patients. The project’s simplicity and interoperability and the international standards adopted for implementing the fully-developed model should make for easy replication in other parts of the world. Furthermore, the lessons learnt during this experience will help programmes of a similar nature elsewhere achieve good results.

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Améliorer l’accès des patients aux soins de santé spécialisés: le réseau de télésanté du Minas Gerais, au Brésil

Problème La population brésilienne manque d’un accès équitable aux soins de santé spécialisés et aux tests de diagnostic, surtout dans les communes reculées, où les professionnels de santé se sentent souvent isolés et où la rotation du personnel est élevée. La télésanté peut améliorer l’accès des patients aux soins de santé spécialisés, mais elle s’agit toujours de choix de son rapport coût-efficacité, de l’accès aux services ou de la satisfaction des utilisateurs.

Approche En 2005, le gouvernement de l’État de Minas Gerais, au Brésil, a financé la création d’un réseau de télésanté, visant à relier les hôpitaux universitaires aux services de santé municipaux reculés de l’État, à soutenir les professionnels dans la téléassistance et à effectuer des télé-électrocardiographies et téléconsultations. Le réseau utilise un équipement à faible coût et a recouru à diverses stratégies pour surmonter les obstacles relatifs à l’utilisation de la télésanté.

Environnement local Le réseau de télésanté relie les spécialistes des hôpitaux universitaires de l’État aux professionnels des services de santé primaires de 608 communes du grand État de Minas Gerais, beaucoup d’entre eux se trouvant dans des zones reculées.

Changements significatifs De juin 2006 à octobre 2011, 782 773 électrocardiogrammes et 30 883 téléconsultations ont été effectués par l’intermédiaire du réseau, et 6 000 professionnels de santé ont été formés à son utilisation. La plupart de ces professionnels (97%) se sont montrés satisfaits du système qui offrait un bon rapport coût-efficacité, était économiquement viable et évitait 81% des renvois potentiels de cas vers des centres éloignés.

Leçons tirées Pour être un succès, un service de télésanté doit faire partie d’un réseau collaboratif, satisfaire les besoins réels des professionnels de santé locaux, utiliser une technologie simple et disposer d’au moins quelques éléments en face à face. En cas d’application à des problèmes sanitaires pour lesquels la demande de soins est élevée, ce type de service peut être économiquement viable et aider à améliorer l’accès des patients aux soins de santé spécialisés.

Résumé

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Resumen

Mejora del acceso del paciente a la asistencia sanitaria especializada: la red de telesalud de Minas Gerais, Brasil

Situación
La falta de igualdad en el acceso de la población brasileña a la asistencia sanitaria especializada y a las pruebas diagnósticas, en especial, en municipios remotos, resulta en que muchos de estos profesionales se sienten aislados y la rotación de personal es alta. La telesalud tiene el potencial de mejorar el acceso a la asistencia sanitaria especializada, pero se dispone de poca información en cuanto a la eficacia en relación a los costes, al acceso a los servicios o a la satisfacción del usuario.

Enfoque
En el año 2005, el gobierno del estado de Minas Gerais, Brasil, financió el establecimiento de la Red de Telesalud con la intención de conectar a los profesionales de asistencia sanitaria especializada en municipios remotos del estado, así como para ayudar a los profesionales a que pudieran proporcionar asistencia y realizar electrocardiografías y consultas a distancia. La red utiliza equipos de bajo coste y ha empleado varias estrategias para superar las barreras del uso de la telesalud.

Marco regional
La red de telesalud conecta a los especialistas de los hospitales universitarios estatales con los profesionales de asistencia sanitaria de municipios remotos del estado, así como para ayudar a través de la red y se formó a 6.000 profesionales sanitarios en su uso. La mayor parte de estos profesionales (97%) estaban satisfechos con el sistema, que ofrece una buena eficacia en relación a los costes, es económicamente viable y evitó el 81% de las referencias de casos potenciales a centros distantes.

Lecciones aprendidas
Para conseguir resultados, un servicio de telesalud debe formar parte de una red colaborativa, cubrir las necesidades reales de los profesionales sanitarios locales, utilizar tecnologías simples y tener al menos algunos componentes cara a cara. Si se aplica a los problemas sanitarios para los que existe una alta demanda de asistencia, este tipo de servicio puede ser económicamente viable y ayudar a mejorar el acceso del paciente a la asistencia sanitaria especializada.

Referencias