

Brazilian National Service of Telediagnosis in Electrocardiography

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Abstract

Access to specialized care remains unsolved in Brazil. The National Telediagnosis Project was created to expand successful telediagnosis experiences nationwide. The Telehealth Network of Minas Gerais (TNMG) was selected as a reference for tele-electrocardiogram (ECG). We aim to describe the experience of TNMG of developing and implementing the Brazilian National Service of Telediagnosis in Electrocardiography. Implementation planning includes discussion of workflows, standard procedures, responsibility definition for stakeholders, and adaptation of TNMG telediagnosis system. Tele-ECG has been implemented in 79 municipalities in 5 states. In a survey with 152 health professionals, 57% noted that ECG was not available in the local public health system before, 63% indicated tele-ECG service utilization ≥ 3 days per week, 96% considered the service very useful and 89% were very satisfied with it. In conclusion, the service fills a gap in specialized care in the public system and can improve access to a basic exam in remote and underserved regions.

Keywords:

Electrocardiography, Telemedicine, Access to Health Care

Introduction

Brazil is a country with continental dimensions, divided into 5 regions, including 27 states and 5,507 municipalities. There are important economic, social and cultural differences among the regions. Although the universal public health system, created in 1988, operates nationwide, with a broad coverage of Primary Care, access to specialized care is still an unsolved problem. These inequalities made the country a promising field for the implementation of telehealth. Therefore, in 2007 the Brazilian Ministry of Health (BrMoH) created the Brazilian National Telehealth Program, to support family health teams through teleconsultation, telediagnosis and teleeducation performed by Telehealth Centers (TC) established in different states of the country. Currently, there are 25 TC in operation at different development levels.

The Telehealth Network of Minas Gerais (TNMG) is a collaborative network of seven public universities in the state of Minas Gerais, Southeast Brazil, coordinated by the University Hospital of *Universidade Federal de Minas Gerais* [1]. It was implemented in 2005 and currently provides telehealth care for 813 municipalities in Minas Gerais, mainly in primary health care (PHC) centers, but also in emergency departments, ambulances and hospitals. Being one of the first TC to participate in the Brazilian National Telehealth Program, it has a long and wide experience in telediagnosis in cardiology. Over

3.8 million tele-electrocardiogram (ECG) reports and over 124,000 teleconsultations have already been performed, as well as tele-retinography, Holter and tele-education activities, with quality assured by regular audits.

In 2017, the BrMoH established a National Telediagnosis Project as part of the Brazilian National Telehealth Program, in order to expand successful telediagnosis regional experiences to a nationwide scale.

The preliminary telediagnosis experiences chosen comprehended ECG, retinography, dermatology and spirometry. The TNMG was chosen to be one of the first National Telediagnosis Project participants, helping BrMoH in its conception and offering tele-ECG reports.

The present work describes the experience of developing and implementing the Brazilian National Service of Telediagnosis in Electrocardiography (BrNSTE) during its first year of operation, under the framework of the BrMoH National Telediagnosis Project.

Methods

The BrMoH National Telediagnosis Project was conceived as an innovative process to perform exams using telemedicine tools in an organized way, with quality and low cost, to significantly improve the availability of certain exams, especially to remote regions with low human development index (HDI) and restricted access to specialized care.

The Project consists of a partnership of BrMoH, State Health Department, Municipal Health Department, specialized TC and regional TC (RTC). The criteria used by the BrMoH to choose a specialized TC to offer certain exam are based on the TC previous proven experience and capacity to significantly expand its offer at low cost. BrMoH only selects states to implement the project which have a RTC in operation with ongoing funding by BrMoH.

A National Telediagnosis Platform, developed by BrMoH demand to *Universidade Federal do Rio Grande do Norte* (UFRN), was integrated to TNMG telediagnosis system in order to manage the project. The TNMG telecardiology service, besides performing the ECG reports, also provides synchronous teleconsultation to local medical doctors to discuss the severe clinical cases. Educational material for tele-education in cardiology is available on TNMG website to support local health professionals.

Implementation planning includes flows and standard procedures, role and responsibility definition for stakeholders, adaptation and customization of TNMG telediagnosis system. The implementation process starts with a presencial two-day training of the RTC team at TNMG. The two first local

implementations are made by RTC team together with the TNMG team to guarantee the success of the implementation.

The impact of implementation of BrNSTE on local healthcare was assessed in a survey with health professionals, health unit coordinators and health managers from 35 towns in Acre, Bahia and Mato Grosso in June and July 2018. A Likert-scale questionnaire with 8 questions was developed. Professionals were contacted at last 3 times by telephone or email. There were attempts to contact 409 professionals, but email addresses and telephone numbers were wrong for some of them. We tried to get at least one professional of each category (doctors, nursing staff, coordinators) in each health unit.

Results

In September 2017, the BrNSTE was launched in the remote town of Xapuri (state of Acre), in the Amazonian region. Since then, the service is being expanded to other Brazilian states, as Bahia (November 2017), Mato Grosso (February 2018), Ceará and Roraima (October 2018). Other states have been chosen by the BrMoH to receive the Project for the next months.

From September 2017 to October 2018, the BrNSTE delivered through the TNMG 33,178 tele-ECGs for 79 municipalities.

TNMG telecardiology service works 7 days / 24 hours. It has a response time below 10 minutes for emergency ECGs and between 2 and 4 hours for elective ones. On average, each town performs 90 ECGs/month. Utilization ratio (defined as number of towns using the system divided by number of towns with the system implemented) is monitored monthly, and is always above 90%.

With regards to the questionnaire, from the 152 respondents 57% informed that, before the implementation, the ECG was not available in the local public health system; and even when it was available, no standardized report was provided. After implementation of BrNSTE, 63% indicated tele-ECG service utilization ≥ 3 days per week; 94% considered as adequate the time to receive the report. In addition, 96% of respondents reported the tele-ECG service very useful, 98% indicated much benefit for patients and 89% were very satisfied with it. There were not significant differences in responses according to professional category.

Discussion

The present study describes the deployment of a large and complex telehealth service, developed under the guidelines of a national policy with the collaboration of different stakeholders, including a TC with expertise in tele-ECG, regional TCs, responsible for local implementation, an University (UFRN) that provides support for the BrMoH activities and the BrMoH itself. The results reported above demonstrated that the project was successful, reaching 79 towns in 5 different Brazilian states, including some very remote locations, in the Amazon region and in the Northeast of the country. A large number of ECG from these places have been performed and analyzed, with a utilization ratio of more than 90%. For most of these places, an ECG service was not available before the implementation of the BrNSTE. Health professionals, coordinators and managers have shown to be satisfied with the service.

Cardiovascular diseases are the most important causes of death in Brazil and in most developing countries. ECG is a basic method of recognition of cardiovascular diseases, useful also for risk stratification and evaluation of prognosis. For some cardiac diseases, as myocardial infarction and arrhythmia, ECG is the basic diagnostic tools and treatment is not possible without rapid and immediate availability of the exam. Since BrNSTE

provides timely and accurate diagnosis 24/7, it has an enormous potential of improving the access of patients from these remote and resource-constrained localities to adequate health care, reducing acute and long-term morbidity and mortality.

There are other experiences of large tele-ECG services, in Brazil [2] and other developing countries [3], but many projects are devoted to acute coronary syndrome or have a more restricted area of coverage. The present report describes a nationwide initiative that seems to be unique, with high utilization ratio and excellent satisfaction of the users.

The study also opens the possibility of universalization of the access to medical diagnostic methods through the use of simple, low-cost telehealth systems. Indeed, the possibility of scaling-up the service provided, as well as other diagnostic methods, to the whole Brazilian population points out for a solution for some of the access barriers that currently hasten the effectiveness of the Brazilian Universalized Health System. Additional challenges include the full integration of this service to the electronic health records provided by the BrMoH and the sustainability of the BrNSTE as a permanent policy of the country.

Conclusions

In conclusion, a Brazilian National Service of Telediagnosis in Electrocardiography was implemented in 2017, based in the experience of the state of Minas Gerais, and it is now established in 5 other Brazilian states, with several other states already waiting for implementation. The service fills a gap in specialized care in the Brazilian public health system and can improve access to a basic exam in remote and underserved regions, with a potential to decrease morbidity and mortality related to cardiovascular diseases, the most common cause of death in Brazil.

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