

Interventions to bring comprehensive care to people with Chagas disease: Experiences in Bolivia, Argentina and Colombia



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ABSTRACT

Chagas disease (CD) affects over six million people and is a leading cause of heart failure in the Americas. Few are able to access diagnosis and treatment for CD, resulting in a missed opportunity to prevent morbimortality. Integration of testing and treatment with the primary healthcare level is a key step in ensuring affected people receive timely antitrypanosomal therapy, which increasing evidence shows can prevent chronic complications from the disease and halt congenital transmission. This article describes three collaborative projects focused on increasing access to testing and treatment for CD through primary healthcare facilities in Bolivia, Argentina, and Colombia.

1. Introduction

Chagas disease (CD), similar to other neglected tropical diseases (NTDs), primarily affects marginalized populations with limited access to healthcare. CD causes an estimated 14,000 deaths a year and an annual global burden of over 800,000 disability-adjusted life years (Lee et al., 2013; Pan American Health Organization and World Health Organization, 2017). Although vector control programs have made significant progress, foci of active vector transmission persist, in addition to congenital, oral, and other forms of transmission, and the estimated six to seven million people infected by *Trypanosoma cruzi* (Basile et al., 2011; Manne-Goehler et al., 2016; World Health Organization, 2015) have severely limited access to proper healthcare. While there are substantial limitations in the available diagnostic and therapeutic arsenal, including the lack of a reliable test of cure, increasing evidence indicates antitrypanosomal treatment eliminates the parasite and reduces subsequent morbidity and mortality (Cardoso et al., 2018; Fabbro et al., 2007; Viotti et al., 2006). It also prevents congenital transmission (Fabbro et al., 2014; Moscatelli et al., 2015b; Sosa-Estani et al., 2009). However, to be most effective, this treatment needs to be provided before CD progresses to an advanced

chronic stage, making it urgent to test and treat people as soon as possible. Still, less than 1% of people with CD in the Americas, and less than 10% in Europe, have obtained diagnosis and treatment (Basile et al., 2011; Costa Chaves et al., 2017; Cucunuba et al., 2017; Manne-Goehler et al., 2015; Manne et al., 2013). Moreover, the neglect of CD occurs in various contexts, from major cities to remote rural areas, in endemic and non-endemic countries, and in diverse public health systems, including those guaranteeing universal health coverage.

Improving access to healthcare for CD and other NTDs is a critical aspect not only of achieving the United Nations Sustainable Development Goals, but assuring healthcare as a human right (World Health Organization, 2010). While several different approaches define access (Frost and Reich, 2009; Peters et al., 2008; World Health Organization, 2004), there is general agreement that access entails providing affordable services of good quality, with appropriate healthcare technology, in geographically accessible settings, and in a culturally appropriate manner. This means ensuring diagnosis and treatment for CD are available in primary healthcare facilities (World Health Organization, 2010).

Achieving this goal entails creating programs which are custom-built to confront the unique challenges posed by CD, including low

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awareness among healthcare personnel, limited recognition of CD in the at-risk population (largely due to CD's long asymptomatic period), and limited availability of antitrypanosomal drugs and tests in health systems. Moreover, diagnosis of CD can produce a significant emotional impact on patients (Costa et al., 2019), who may also suffer stigma and discrimination, including loss of employment. Some may require specialized care for CD's cardiac, gastrointestinal, and neurological complications, and many are confronting co-morbidities including HIV, diabetes, and depression, (Hidron et al., 2010; Jackson et al., 2012; Ozaki et al., 2011) while facing economic deprivation and, in the case of transnational migrants, adjustments to a different, sometimes exclusionary social and cultural environment (Forsyth et al., 2018).

1.1. Addressing barriers to CD healthcare in different contexts

Comprehensive care models seek to address the range of social, emotional, and biological impacts of CD. Comprehensive care encompasses not only treatment of all disease phases, but health promotion, prevention, capacity building, and other activities (World Health Organization, 2011). For example, community outreach and partnership with patient associations represent ways to address the psychosocial impacts of CD (Oliveira, 2009). However, approaches should be adjusted to local contexts, which might vary considerably. In recent years, new programs have demonstrated that it is possible to overcome barriers in diverse contexts and provide affordable, accessible healthcare to people with CD at a low cost to health systems. This article describes three such programs which have improved access for patients in Bolivia, Argentina and Colombia. Their shared experience suggests pathways health systems can follow to ensure all people with CD receive appropriate, timely care.

2. A transnational and translational program between an endemic and a non-endemic country: The Bolivia-Barcelona chagas platform

In Bolivia, six out of ten people are at risk of acquiring CD. Comprehensive solutions to improving CD control are essential. In 2006, management of CD was declared a national priority (Plurinational State of Bolivia, 2006). The Ministry of Health's National Chagas Program, a vertical program, is the technical, normative and governing unit responsible for entomo-epidemiological surveillance, through the promotion, prevention, care and control of CD in the Bolivian population. The program employs an integral and intersectoral approach, with national direction but decentralized operations at departmental and municipal levels. The program's 2015 Strategic Plan included diagnosis, treatment, education, promotion and prevention activities (Programa Nacional de Chagas, 2008), but regulatory provisions for implementing this plan were lacking. For years, local authorities recognized the burden of the disease; Bolivia has the highest prevalence in the world (6.1%) (World Health Organization, 2015). However, a specific healthcare protocol for adults in the chronic stage of CD was not yet a reality, due in large part to the epidemiological scenario, in which house infestation rates by the main vector were higher than 50%. Therefore, CD control through vector control and entomological surveillance was prioritized. Concurrently, there was a need for local technical and economic support for other intervention areas such as newborns and children with CD (Alonso-Vega et al., 2013). Clinical management of CD was supposed to be implemented in primary healthcare centers, following international recommendations (WHO Expert Committee on the Control of Chagas Disease, 2002). Nevertheless, because no model for care of adults with chronic infection was defined before 2009, primary health care centers did not consider providing etiological treatment for this population. Moreover, outdated conceptions regarding etiologic treatment effectiveness (Kierszenbaum, 2005; Viotti et al., 2014), plus the high toxicity of current drugs (Jackson et al., 2010; Pinazo et al., 2010), underscored

the need for training of Bolivian healthcare workers in prevention and clinical management of CD. Finally, the lack of information for populations at risk, even on fundamental issues such as the benefits of etiological treatment, together with fear and stigma related to CD, limited patient demand for diagnosis and treatment (Sanmartino et al., 2015; Ventura-Garcia et al., 2013). A comprehensive solution was needed to address this complex socioeconomic and public health issue.

2.1. Design

In 2009, the Bolivian Chagas Platform for comprehensive healthcare for adults with CD was born as a collaboration between local and international actors. Core partners included the Barcelona centre for International Health Research (ISGlobal)-Hospital Clínic; and Fundación Ciencia y Estudios Aplicados para el Desarrollo en Salud y Medio Ambiente (Foundation for Science and Applied Studies for Health Development, or CEADES), together with the Agencia Española de Cooperación Internacional para el Desarrollo (Spanish Agency for International Cooperation and Development, or AECID) and the Bolivian National Chagas Program.

The main objective of the Bolivian Chagas Platform is to contribute to the control of CD, through a model based on four pillars (Pinazo et al., 2017):

- 1 Provision of healthcare according to specific protocols, including development of a database.
- 2 Creation of expertise in management of CD and building capacity for research, based on cooperative efforts between Bolivian and Spanish investigators.
- 3 Training health professionals in the management of CD, both in Barcelona and in Bolivia.
- 4 Promotion of educational activities in the community, including creation, in partnership with civil society, of didactic and informative materials adapted to local contexts in Bolivia and in Barcelona.

In an initial seven-year phase, a vertical strategy was implemented in seven specialized healthcare centers in Bolivia (located in three endemic departments), and in the International Healthcare Unit in the Hospital Clínic in Barcelona.

One of the main characteristics of the model was its transnationality: protocols, practices and lessons learned during the ten-year process were applied in patients attending Bolivian centers as well as in the International Healthcare Unit in the Hospital Clínic in Barcelona. This approach allowed migrant patients and families to continue their clinical follow-up in both countries, which increased patient confidence throughout the process, and also avoided loss of follow-up given this population's frequent travel between Bolivia and Spain. Once the proposed strategy was proven effective, with high demand from the population, the National Chagas Program declared the Bolivian Chagas Platform a quality model to be scaled-up nationally.

The second four-year phase consisted of expansion to primary healthcare centers within the National Health System, using a novel strategy based on the network of centers created in the initial program phase. The Bolivian Chagas Platform's expansion was designed and implemented with departmental and municipal health authorities, under the umbrella of the National Chagas Program. The main steps to expand the vertical model were: (a) define intervention areas together with departmental Chagas programs; (b) strengthen expertise in healthcare professionals through training within seven Platform centers, to better adapt and simplify healthcare protocols to local situations; (c) develop referral and counter-referral pathways between primary and specialized care centers; (d) establish an evaluation-training system via the Chagas Departmental heads, with technical support from Bolivian Chagas Platform staff; and (e) increase awareness in civil society via community health promotion and educational activities.

Table 1
People screened and diagnosed by the Bolivian Chagas Platform*.

	People screened	People with <i>T. cruzi</i> infection (serological diagnosis)	Prevalence of <i>T. cruzi</i> infection in the population covered
7-year vertical phase (2009–2015)	26,227	18,316	69.8%
4-year horizontal phase (2015–2018)	150,800	27,133	17.9%
Total intervention	177,027	45,449	25.7%

* Bolivia only, does not include Barcelona.

Training and implementation of operational research was developed in the initial phase and carried out during the whole project. The Bolivian Chagas Platform strengthens management of CD through investigation. Research findings are applied to healthcare and staff training, providing information permitting National Health System personnel elements to analyze and reformulate priorities in public health interventions. Thus, the Bolivian Chagas Platform is considered a translational model.

2.2. Outcomes

Table 1 details screening results for the vertical and horizontal phases of the Bolivian Chagas Platform. Although a vertical strategy offers less total screening coverage, it is effective at reaching people with CD. The horizontal strategy screens a larger population with seroprevalence rates closer to reality (although *T. cruzi* seroprevalence in people attending Bolivian Chagas Platform centers is impacted by selection bias). Forty percent of patients with *T. cruzi* infection started specific treatment with benznidazole or nifurtimox (Pinazo et al. unpublished).

Seven specialized centers were operational in the vertical phase, and 48 healthcare centers joined the network in the second phase (covering 90% of healthcare centers in the intervention area). Training on the practical implementation of the model for each area, designed by the departmental head of Chagas, was provided to 748 Bolivian health professionals, comprising 67% of healthcare workers in the intervention area. Twenty research projects were submitted to scientific and ethical committees (12 are still ongoing). CD research studies include three clinical trials with new drugs, one study on biomarkers of disease progression, (other biomarkers were investigated in clinical trials), and epidemiological and entomological studies. Several research protocols were implemented both in Bolivia and in Barcelona, allowing sharing of research procedures and comparison of results.

In conclusion, the translational and transnational Bolivian Chagas Platform is an effective model to provide healthcare to people at risk of having CD. It combines clinical, training, research, educational and health promotion activities into a unified healthcare package.

2.3. Bolivian platform, limitations and lessons learned

Although the Chagas Platform successfully increased diagnosis and treatment coverage in its vertical and horizontal approach, several limitations were identified:

- 1.- Limited human resources, even with the scaling up of the model to primary healthcare centers, due to the high ratio of patients/healthcare staff.
- 2.- Differences in adaptation of healthcare protocols, necessitating close follow-up by personnel who know and understand the model in-depth.
- 3.- Process surveillance and quality, that was initially performed by both Chagas Platform and departmental personnel. Sustainability depends on national health officials maintaining this surveillance.
- 4.- Weak and/ or incomplete public health information systems can limit implementation and follow-up.
- 5.- Political commitment is essential for viability at each stage of the

process (start-up, implementation, evaluation) and the sustainability of actions and plans implemented.

- 6.- Drug supply, usually dependent on external factors, was a clear limitation to increasing treatment access. Benznidazole stock ruptures due to production gaps discouraged people from seeking testing and damaged program credibility during implementation.

3. An innovative Argentinean chagas disease program for primary care units: The challenge of promoting access to early diagnosis and treatment

Argentina has the largest population with CD in the world (World Health Organization, 2015). Historically, CD has been concentrated in rural populations, and this association has influenced the medical training process. Cases of CD were expected in remote rural areas rather than large cities (Jorg and Storino, 2014; Viotti and Vigliano, 2015; Zabala, 2009). However, due to migratory patterns, there has been a significant increase of affected people in urban centers. Currently, Buenos Aires (with no vector) is the city with the largest infected population (Moscatelli et al., 2015a). This rural-urban shift occurred within a few decades, but health policy makers were slow to react to the changing epidemiology of the disease and initially unprepared to meet potential increased demand for CD diagnosis and treatment in cities. Only a few specialized centers were available to handle the healthcare needs of all patients with CD living in Buenos Aires and surrounding areas. In a country with a large territory and significant internal migration, the lack of specific service providers constitutes an important healthcare access barrier.

Argentina's health system provides mixed coverage, which for those without jobs or in the informal sector is financed by the state, while others obtain coverage through formal employment. There is a wide availability of public hospitals and free primary care centers. By 2002, nearly 10,000 such centers were distributed across Argentina's 24 provinces. While diverse in terms of technical and human resources, they constitute an important healthcare provider for patients affected with chronic diseases or common acute illnesses.

Concurrently, Mundo Sano Foundation (MS), a non-governmental organization focused on the prevention of NTDs, began promoting early diagnosis and treatment of CD through municipal primary care facilities (MPCF) in the city of La Plata, capital of Buenos Aires Province, a non-endemic area. A primary objective of the project was to develop a customized program for early diagnosis and treatment for CD, and to demonstrate the utility of primary care for achieving this goal. A pilot project was implemented in 2010 (Lenardòn et al., 2014). The pilot project's results encouraged local authorities to roll out MS's CD diagnosis and treatment program to the 46 MPCFs in La Plata.

3.1. Design

A framework agreement between MS and the Municipality of La Plata was signed in 2010. Initially, a pilot project was designed and implemented in three MPCFs and three rural schools during 2011–2013 (Lenardòn et al., 2014). The three MPCFs and schools were chosen by local authorities. All were located far from the city, in an area with a large migrant population. Health teams from the three MPCFs were trained in CD diagnosis and treatment according to Argentina's National

Guidelines for CD from the Ministry of Health. All persons attending these MPCFs for any reason were asked to answer a few questions related to risk factors for CD (maternal infection, prior residence in an endemic area, previous blood transfusions, and contact with kissing bugs). If a risk factor was identified, the patient was asked to provide a blood sample for CD testing; those with positive results were offered treatment. Pregnant women were systematically tested for CD according to national law. If seropositive, mothers were advised to bring in any prior children for testing and to bring back their infants for testing for congenital CD. Infants with confirmed infection were offered treatment. Additionally, a short survey was administered to children attending public schools to determine the presence of CD risk factors. Families of children considered at risk were advised to consult a pediatrician or general practitioner at the MPCFs.

Healthcare barriers for early diagnosis and treatment of people with CD in La Plata were analyzed using four previously described access dimensions (Peters et al., 2008) with some adaptations relevant to CD. Extensive baseline data were gathered during the pilot project. Many of these indicators were crucial for ensuring an efficient project design. Key geographical barriers included the lack of passable roads during rainy days and limited public transportation. Moreover, there was only one MPCF with an electrocardiogram (ECG). Patients had to travel long distances to hospitals to obtain an ECG, and nearly 30% of patients lacked this essential test for patients with CD (Lenardòn et al., 2014).

When the pilot project finished, a new framework agreement between both organizations was signed in order to extend the program. This new phase added intensive medical training in CD for all the health team members from the 46 MPCFs. The extended project introduced a patient-centered medical model, with all the basic medical procedures and practices to be performed in the MPCFs. ECGs of all the MPCFs were sent to a central service utilizing telemedicine.

3.2. Outcomes

During the pilot project (2011–2013), 475 people were tested and 181 were positive (38%). All patients tested were migrants from highly endemic areas, leading to the high prevalence of CD. All were treated since they fulfilled requirements of the National CD guidelines, with no drop-outs. In the first two years of the extended project period (2014–2015) the number of people tested and treated increased. A patient centered model was designed for diagnosis and treatment with the premise that “the healthcare system needs to move, but not the patient”. The program achieved a high rate of adherence to treatment, with <2% discontinuation. This high retention rate occurred because patients were frequently evaluated: on a weekly basis during the first month and bi-weekly during the second month of treatment. The purpose of the frequent monitoring during the first month of treatment was to ensure that the medication was administered correctly and to minimize the occurrence of adverse reactions. Social workers conducted home visits to patients who failed to attend check-ups to confirm treatment was being properly administered. In 2016, coinciding with elections and subsequent turnover of local authorities, treatment rates fell but then increased again during 2017 (Table 2).

As a result of the implementation of the extended program, 17,894 patients were serologically evaluated for CD diagnosis, 1505 (8.4%) were seropositive and 1069 were treated with antitrypanosomal drugs. The occurrence of adverse reactions to benznidazole was similar to that described by other authors (Pereiro et al., 2018; Viotti et al., 2009). A specific survey to detect risk factors for CD was performed in 3750 children from 46 public schools. A total of 280 children were tested at the MPCFs, 98 were seropositive (35%) and all completed antitrypanosomal treatment. Financing for treatment at the MPCFs came mainly from the municipal budget (some drugs came from the National Ministry of Health). MS bought two electrocardiography machines and paid extra salaries to four local physicians to coordinate clinical management of the MPCFs. Initially, MS hired a cardiologist to read and

analyze ECGs, which were sent through telemedicine from MPCFs to a central location. Finally, when needed, an MS senior physician assisted health teams with problem solving and answering questions. A 24-hour communication line was available for all MPCFs. This was important for building trust between both institutions.

Before the project was implemented, CD treatment was not provided in the MPCFs. Training for health team members in CD is crucial for promoting access to early diagnosis and timely treatment. The project design and the clinical management used in this project, as well as the availability of ECGs, were also beneficial for other chronic diseases such as hypertension and diabetes. Although some adjustments were necessary, primary care facilities fulfilled all the requirements for early diagnosis and treatment of CD.

3.3. Argentina, limitations and lessons learned

- 1) Due to the diversity of the primary healthcare level in Argentina, a careful analysis (infrastructure, human resources and technology) of all the centers involved in a program should be performed before the implementation process.
- 2) The primary healthcare level in Argentina has the capability to provide early diagnosis and timely treatment to patients in early stages of CD.
- 3) Telemedicine is a useful tool that should be considered in order to extend access to healthcare services.
- 4) Before implementation of the project, intensive training of health care teams is highly recommended due to the lack of experience in the administration of antitrypanosomal drugs.
- 5) Local coordination between third level (referral) hospitals and primary care centers is useful in order to avoid problems in access to specialized services.
- 6) Financial restrictions can be a threat in rural areas. Private-public associations can be a way to reduce this risk.
- 7) Since all the available guidelines for diagnosis and treatment of CD are mainly for tertiary healthcare centers, some criteria for primary healthcare centers should be included in order to assure high quality practices.

4. A pilot project to increase access to diagnosis and treatment of Chagas disease in Colombia

Colombia has the fifth largest global burden of CD, with an estimated 438,000 people infected with *T. cruzi*, and 131,000 affected by CD-related cardiomyopathy (World Health Organization, 2015). Access to diagnosis and treatment has been challenging; one study found that only 1.2% of Colombia's at-risk population had been screened, and <0.4% of estimated cases received antitrypanosomal treatment. Further, delays in obtaining confirmatory diagnosis often exceeded a year, and a third of people who screened positive never obtained a confirmatory test (Cucunuba et al., 2017). Barriers to treatment for CD include low awareness among healthcare personnel, distance of facilities offering treatment from communities where patients live, and difficulties in obtaining insurance coverage for testing (Martinez-Parra et al., 2018). Nevertheless, in recent years Colombia has made significant strides in controlling CD transmission by *Rhodnius prolixus* (Ministry of Health and Social Protection, 2017), and also eliminated another NTD, onchocerciasis (Nicholls et al., 2018). Colombia promotes universal health coverage, through a system where some are insured through plans subsidized by the state, while others are in contributive plans.

Building on these successes, Colombia's Ministry of Health and the Drugs for Neglected Diseases initiative (DNDi) developed a collaborative pilot project to increase access to treatment and diagnosis of CD (Marchiol et al., 2017). The goal of the pilot project is to validate a patient-centered roadmap involving simplification of processes, build health system capacity, strengthen provider and public awareness of

Table 2
People tested and treated, La Plata, 2011–May, 2018.

Year	People tested	Sero +	Treated	Without treatment for medical reasons*	Without treatment for other reasons
2011**	112	40	40	0	0
2012**	135	50	50	0	0
2013**	228	91	91	0	0
2014	5902	439	414	23	2
2015	5545	381	354	21	6
2016***	2787	216	37	41	138
2017–May, 2018	3185	288	83	168	37
Total	17,894	1505	1069	253	183

* Pregnancy, > 50 years, cancer, other severe illnesses, etc.

** Pilot project period.

*** Change of local authorities.

CD, and demonstrate the feasibility of offering accessible testing and treatment for CD in endemic areas.

4.1. Design

Although DNDi's original CD strategy focused on strengthening research and development for new drugs, the complex access challenges surrounding CD led to the creation of an access initiative. This program works with in-country partners to address access barriers, ultimately aiming to assure that future treatments for CD can quickly reach patients. While Ministries of Health and local partners lead, DNDi provides technical assistance, working at the national level to support policy change, facilitate availability of trypanocidal drugs, and coordinate training, capacity building, and implementation of simplified care processes at the ground level. The idea is to work with local stakeholders on small-scale pilot projects, using this experience to learn what works well and what needs to be adjusted before scaling up projects nationally. DNDi has developed a 4D methodology for its CD access programs (Batista et al., 2019) comprising four steps briefly outlined below:

Diagnose: A mapping is done of local stakeholders working on CD, and a seminar is held in which barriers are collaboratively identified.

Design: In the barriers seminar, actions are agreed upon and parties responsible for carrying out those actions are identified. Measurable goals are established and baseline data on key indicators are collected.

Deliver: Actions to address barriers are implemented and a process of ongoing capacity building begins.

Demonstrate Impact: Results from the project are compared with baseline indicators to assess progress and identify areas needing improvement or refinement. Results are shared with internal and external stakeholders.

In 2015, different stakeholders including Colombia's Ministry of Health, the National Institute of Health, DNDi, and representatives of academic and civil society participated in a seminar to discuss barriers and potential solutions for increasing access to treatment of CD. Some of the main needs identified were creation of a patient-centered roadmap for CD and simplification of the diagnostic process. In July 2016, an official resolution (Resolution 3202) was published supporting a patient-centered roadmap for CD, but this had yet to be tested in a real-world setting. A pilot project was therefore created to implement a patient-centered CD roadmap in four (and later, five) communities in an endemic region of Colombia. The communities had varying epidemiological profiles and health system capacities, and all expressed interest in participating in the project (Marchiol et al., 2017). The first community implemented the patient-centered roadmap for CD in March 2017 and the rest followed suit during the following fifteen months. Fig. 1 details the chronological development of the pilot.

4.2. Outcomes

The pilot has focused on three key areas: (1) capacity building; (2) simplification of processes; and (3) information, education, and communication. Each are described more fully below:

Capacity Building: One of the first project activities was to strengthen clinical expertise for healthcare personnel in the pilot communities, ensuring CD treatment is available at public primary healthcare facilities. Reference personnel received hands-on training from the Bolivian Chagas Platform, which has extensive experience in treating CD patients. Furthermore, several workshops focusing on different aspects of CD clinical management are held each year in the pilot communities and Bogotá.

Simplification of the Diagnostic Algorithm: Long delays in testing confirmation, often exceeding a year, stemmed from several factors, including lack of availability of confirmatory testing in patients' communities. The confirmatory test, an in-house immunofluorescence assay developed from Colombian *T. cruzi* strains, was only available in a few laboratories and required expensive equipment and extensive training. Patients incurred significant expenses from having to travel to other locations to complete testing. A study was conducted of seven commercial enzyme-linked immunosorbent assays (ELISAs) available in Colombia, which indicated that a combination of two ELISAs could provide comparable accuracy to the previous diagnostic algorithm, while significantly facilitating testing (Caicedo Díaz et al., 2019). With the new testing process, patients need only give one blood sample, which is run by local laboratories against the two ELISAs. After a year of using the new diagnostic algorithm, patients' time to receive confirmatory results has decreased from an average of one year to around two weeks (Herazo et al., 2018). Furthermore, in the first pilot community, the average number of people tested for CD increased from 35 annually before the pilot, to 384 in the first year of the pilot, of whom 95 (25%) were confirmed positive for CD.

Information, Education, and Communication: Low provider and public awareness of CD, which is seldom mentioned in the media and rarely a topic of health education campaigns, has sustained fears and misconceptions regarding the disease in Colombia, as elsewhere (Martinez-Parra et al., 2018). During the design and validation process of IEC tools, interviews were conducted with patients, community leaders, and healthcare personnel in the pilot communities. These indicated several aspects which might discourage patients from seeking care, including the association of CD with death, perceiving it is better not to know if one has the disease, and the notion (often reinforced by providers) that only children and adolescents could be treated. From the perspective of healthcare personnel, there was considerable anxiety about potential adverse effects from treatment. Consequently, separate IEC plans were developed for the community and healthcare personnel. The community IEC plan emphasized that CD could be treated if detected early enough. The provider IEC plan focused on conveying that CD could be treated in adults while reinforcing the importance of ongoing

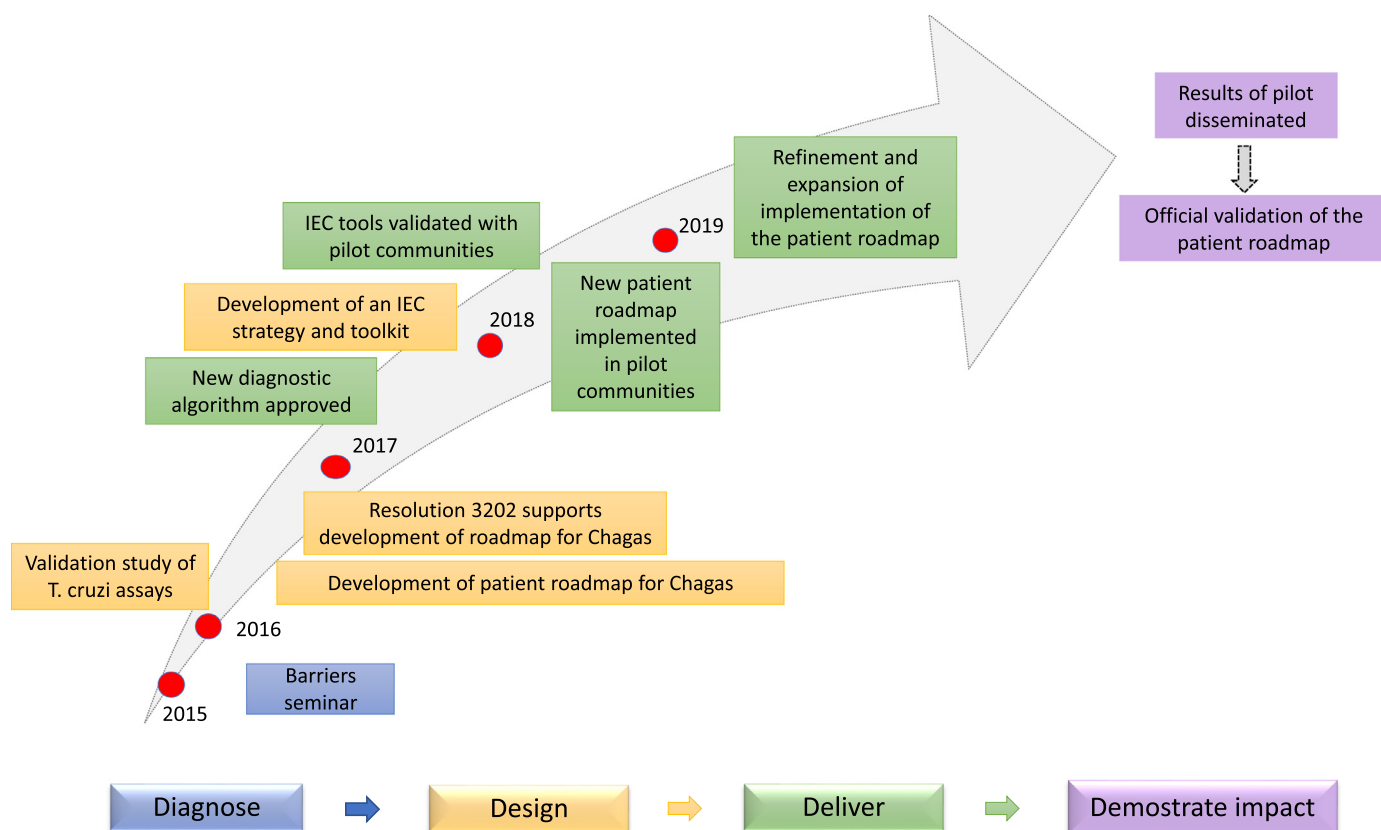


Fig. 1. Chronology of the Colombian Pilot Project for CD According to the 4D approach.

monitoring. The IEC plan received the approval of the Ministry of Health in 2018 and is being implemented in the pilot communities.

The pilot project to increase access to treatment for CD in Colombia has provided several important insights. Identifying barriers (and solutions) in conjunction with national and local stakeholders has been a key mobilizing factor, and the political commitment of different levels of government is a crucial element. Colombia's Ministry of Health and departmental Secretaries of Health have taken a leading role in the project, which ensures its sustainability at the national and departmental levels. The project has also revealed other important challenges; neither benznidazole nor nifurtimox are currently registered in Colombia, but nifurtimox is more commonly used, probably because the health system is able to acquire it for free due to an annual donation from Bayer to the World Health Organization. Wider use of benznidazole is inhibited by its comparatively higher cost to the health system.

Adoption of a patient-centered roadmap incorporating simplified diagnostic and therapeutic procedures, promoting decentralization, can help expand access for people with CD. The fact that the pilot operates in communities which formed part of the vector transmission plan strengthens the political commitment of local authorities and facilitates implementation. Assuring long-term monitoring of patients in more remote communities and increasing access to specialized care for cardiomyopathy and other CD complications both pose important challenges for the future.

4.3. Colombia, limitations and lessons learned

- 1) Implementation of an access seminar involving diverse stakeholders to identify key barriers and solutions permits the development of a roadmap attuned to overcoming gaps in access.
- 2) Working with national and local health authorities to ensure care is delivered through the existing health system while simplifying processes helps assure sustainability.

- 3) Incorporating IEC activities for both communities and healthcare providers helps strengthen demand and improve quality of care.
- 4) Availability of both trypanocides is an important consideration that should be discussed with authorities from the outset.
- 5) At the beginning of the project, there was not always sufficient capacity in terms of infrastructure and training of personnel at the primary healthcare level to fully address diagnosis and treatment of CD, which had previously been highly centralized.
- 6) Capacity building among personnel who provide care to patients and integration of Chagas disease testing and treatment into routine care processes are important for strengthening quality and gaining community trust.
- 7) Administrative complexities in the Colombian health system relating to provision of care have produced some latent difficulties, and barriers based on administrative processes between insurers and health facilities have had to be overcome.
- 8) Implementation of pilots in localities with different contexts permits generation of evidence to form policies that can respond to a broad range of needs.

5. Conclusions and overall lessons learned

The three different experiences described here show that there is more than one model for successful integration of CD testing and treatment into the primary healthcare level. Table 3 compares the different projects. In addition, some fundamental lessons learned were shared by all three programs:

- 1.- The importance of providing CD-specific training to healthcare personnel;
- 2.- Establishing a collaborative effort among stakeholders at different healthcare levels, according to national and local regulations;
- 3.- Securing the commitment of public health authorities, which not

Table 3
Chagas access projects in comparison.

	Bolivian Chagas platform	La Plata project, Argentina	Colombian pilot project
Implementation Year	2009	2011	2017
Setting	Rural/urban, endemic	Urban and periurban, nonendemic	Rural, endemic
Prevalence in patients screened (% seropositive)	25.7	8.4	14.5
Main objective	Reinforce Chagas National program to offer diagnosis and treatment for people at risk of having <i>T. cruzi</i> infection	Develop a customized program for early diagnosis and treatment for CD, and implement in the primary care level	Implement an official patient-centered roadmap for CD in an endemic area.
Key challenge	Scale up protocolized healthcare to primary healthcare centers	High quality clinical management in the primary care level.	Reducing the time between diagnosis and initiation of treatment.
Key Lesson learned	Social participation is essential for increasing diagnostic coverage, the key to expanding access.	It is possible to diagnose patients in the primary healthcare level by providing support with capacity building.	Identifying and addressing diagnostic barriers through simplification of processes is fundamental.

- only facilitates project implementation, but bolsters sustainability;
- 4.- Employing a focused IEC strategy to raise awareness among healthcare personnel and the target population, thereby increasing demand, while also modifying perceptions that discourage testing and treatment of CD;
 - 5.- Including impact indicators with clear baseline data and agreement on how to measure progress. Intermediate evaluations as well as critical analysis of indicators used to measure interventions are also relevant.

At the beginning of an intervention, it is important to inform and engage people at risk of having the infection, provoking increases in healthcare demand. Consequently, changes in beliefs, attitudes, and behaviors of medical staff and patients should be addressed through a communication strategy. Collaboration and coordination between primary healthcare networks and different levels of government is critical for implementation and sustainability of programs. Another important lesson learned is to implement the model progressively, facilitating health system adaptation to increasing demand, and to develop a referral and counter-referral system to cover the full range of health problems.

While key indicators in each project involved coverage of screening and access to etiological treatment, other indicators relevant to comprehensive care are recommended for future projects. Etiological treatment is contraindicated for many patients with CD due to existing complications or other factors, but it is still important to measure whether these patients are able to access specialist care. Validating IEC tools with local communities is a key step, and attitudes on CD treatment should be measured at baseline and subsequently evaluated to determine if IEC strategies are successfully reaching the target population. Furthermore, beyond measuring screening and treatment coverage, quality indicators such as availability of ECGs, facilities with personnel trained in CD treatment, and time lapses between testing and treatment are useful for gauging program performance.

While the projects described here focused on improving biomedical treatment of CD, it should be noted that diverse local practices for managing CD already exist, and could mitigate some of the psychosocial impacts of CD. A range of plants and other ethnomedical treatments are used in Bolivia for CD and other conditions (Forsyth, 2017). Integration of local healing practices with biomedical treatment represents a potential way to increase access to CD healthcare (Bastien, 1998), and in Bolivia, especially, traditional medicine has significant official support. Integrating traditional medicine with CD treatment represents an important next step for future projects focusing on CD treatment.

The projects also encompassed different social and environmental contexts. While the Colombian project is centered in predominantly rural communities, rural-urban migration is an important phenomenon and large numbers of people with CD live in Colombia's major cities. The Colombian pilot complements vector control activities by providing

a next step for communities where vector transmission is halted. Indeed, projects in endemic areas should be closely aligned with local vector control activities. In contrast, La Plata represents a different context, without local vectors and with a large population of internal migrants. The fact that CD no longer exists solely in traditional endemic areas calls not only for programs adapted to local contexts, but for national policies covering screening of pregnant women and availability of treatment for people at risk of CD.

In all three experiences pilot studies were initially implemented, but they came from different operative levels. In each case, pilot projects produced structural changes when implemented, increasing access to diagnosis and treatment. Two out of the three were already in the scaling-up phase, showing success in terms of coverage, while the third drove significant local improvements after its first year. Each project opens doorways to comprehensive care via the primary healthcare level. However, ultimately achieving this goal entails ongoing close collaboration, not only with specialist care but with relevant social and mental health services

Each initiative took a somewhat different strategic approach. Specific strategies were used in the Argentinean intervention in order to actively prioritize coverage of women of fertile age and children. In the Bolivian experience, operational research was included as another pillar in the model. The Colombian strategy included a deep initial collaboration with local stakeholders, achieving high commitment of local and national authorities as a starting point.

Among limitations, gaps, and barriers identified by the three models, it is important to highlight continuing access challenges for current antitrypanosomal drugs, and the need to validate new treatment strategies while improving current ones. Improved efficacy and safety of drug therapy, combined with a reliable test of cure and enhanced diagnostic capability, are crucial short-term needs from the research and development sector that will directly improve access. Nevertheless, the three experiences highlighted here provide ways of integrating care for CD into the primary care level, which is the crucial next step in combatting this neglected disease.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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