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How universal is coverage and access to diagnosis and treatment for Chagas disease in Colombia? A health systems analysis

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ABSTRACT

Limited access to Chagas disease diagnosis and treatment is a major obstacle to reaching the 2020 World Health Organization milestones of delivering care to all infected and ill patients. Colombia has been identified as a health system in transition, reporting one of the highest levels of health insurance coverage in Latin America. We explore if and how this high level of coverage extends to those with Chagas disease, a traditionally marginalised population. Using a mixed methods approach, we calculate coverage for screening, diagnosis and treatment of Chagas. We then identify supply-side constraints both quantitatively and qualitatively. A review of official registries of tests and treatments for Chagas disease delivered between 2008 and 2014 is compared to estimates of infected people. Using the Flagship Framework, we explore barriers limiting access to care. Screening coverage is estimated at 1.2% of the population at risk. Aetiological treatment with either benznidazol or nifurtimox covered 0.3–0.4% of the infected population. Barriers to accessing screening, diagnosis and treatment are identified for each of the Flagship Framework's five dimensions of interest: financing, payment, regulation, organization and persuasion. The main challenges identified were: a lack of clarity in terms of financial responsibilities in a segmented health system, claims of limited resources for undertaking activities particularly in primary care, non-inclusion of confirmatory test(s) in the basic package of diagnosis and care, poor logistics in the distribution and supply chain of medicines, and lack of awareness of medical personnel. Very low screening coverage emerges as a key obstacle hindering access to care for Chagas disease. Findings suggest serious shortcomings in this health system for Chagas disease, despite the success of universal health insurance scale-up in Colombia. Whether these shortcomings exist in relation to other neglected tropical diseases needs investigating. We identify opportunities for improvement that can inform additional planned health reforms.

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1. Introduction

Approximately 5.7 million individuals are infected with *Trypanosoma cruzi*—the aetiologic agent of Chagas disease—across the twenty one Latin American countries where the disease is endemic (World Health Organization, 2015). Chagas disease is a leading cause of cardiomyopathy and responsible for considerable social

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and economic hardship. It has been estimated that, on average, an infected individual incurs US$474 in health-care costs annually and $3456 across their lifetime (Lee et al., 2013). Precarious access to care and difficulties in the supply of diagnosis and treatment for those with Chagas disease have been reported, in both endemic and non-endemic countries, as the main obstacles for reaching the World Health Organization (WHO) and London Declaration goals of having all infected and ill patients receiving care by 2020 (Tarleton et al., 2014).

Chagas disease is caused by infection with the parasite *T. cruzi*, which is usually transmitted by a triatomine insect vector. The infection can also be transmitted by blood transfusion, organ transplantation, and via congenital and oral routes. The disease has an initial acute stage, which is usually asymptomatic. However, in a small proportion of cases, this stage can cause severe symptoms. A chronic phase ensues, which is asymptomatic for the majority of those with the infection. However, approximately 30–40% of infected people progress, from a few years to decades after the initial infection, to a chronic, clinically active phase of the disease, involving potentially fatal cardiac or gastrointestinal complications (Rassi and Marin-Neto, 2010; Cucunubá et al., 2016). Public health interventions for Chagas disease in Latin America have focused on interruption of transmission by blood-bank screening and vector control (mainly through insecticide spraying, but also in some cases by housing improvement, health education, and social changes such as migration and modernization) (World Health Organization, 2010). These strategies have shown success in decreasing incidence and burden of disease over time (Hashimoto and Schofield, 2012; Schofield et al., 2006). A reduction by approximately 90% in the prevalence (from 10% to <1%) in children in endemic areas over the last four decades in the Southern Cone countries (Dias, 2007) has led to the goal of interrupting domiciliary transmission in endemic countries (World Health Organization, 2012). These initiatives have not, however, been designed to provide care (diagnosis and treatment) to people already infected. Even if interruption of transmission were achievable, given the chronic course of the disease, people already infected need a responsive health system to meet their health care needs (Manne et al., 2012).

Diagnosis and treatment of Chagas disease is not an easy task. Diagnosis requires conducting at least two different serological tests, which makes it logistically and financially challenging. To date, there are only two drugs available as aetiological treatment: benznidazol and nifurtimox. Both have proven to be more efficacious in early stages and both are associated with frequently reported side effects (Villar et al., 2014). A large clinical trial recently tested the efficacy of benznidazole amongst adults and found an inconclusive effect when heart complications were already established (Morillo et al., 2015), which suggests there is still debate about the impact of such etiological treatments as the disease progresses. Nevertheless, there is consensus on the need to offer these aetiological treatments to patients, particularly in early stages and that symptomatic treatment, (such as heart failure and anti-arrhythmic drugs, pacemakers and transplants) becomes paramount for advanced stages (Carlos Pinto Dias et al., 2015).

This analysis focuses on the epidemiological and health system status of Colombia, where epidemiological data suggest that approximately 437,960 people are infected with *T. cruzi*, 30% of whom have already developed the chronic cardiac form of Chagas disease (World Health Organization, 2015). Blood-bank screening in Colombia was declared mandatory in 1995, and since 2003 it has achieved 100% coverage. However, it was not until 2008 that the Ministry of Health set up a national programme aimed at controlling, preventing and treating Chagas disease (Appendix A, Figure A1 depicts a summary timeline of policy changes). To date, there has been no assessment of whether, and how, these recommended diagnostic and treatment pathways, introduced in 2011 (Ministerio de Protección Social, 2011), have been incorporated into the health system which makes it difficult for policy makers to make informed decisions on resource allocation and improvement of services.

1.1. Overview of health system structure in Colombia

The Colombian health system has been considered a highly successful example of a health insurance-regulated market (Giedion and Uribe, 2009; Lewandowski et al., 2015), with positive effects in terms of health status, financial protection and health care utilisation (Vargas-Zea et al., 2012). A compulsory health insurance system, known as Law 100, was established in 1993, consisting of two main sub-systems, namely, the contributory regime for formal workers and their families, and the subsidised regime for the population outside the formal economy (Londoño et al., 1997). These regimes are administered by private and a few public insurers known as Empresas Promotoras de Salud (EPS)—Health Promotion Enterprises, which are responsible for organising the registration of people in the system and delivering health services through a variety of public and private health care providers (Vargas et al., 2010). Health service delivery is organised across three levels: primary care (basic care attended by general physicians and nurses), secondary care (intermediate care with some specialised physicians, procedures and laboratory), and tertiary care (the most complex procedures and specialisations) (Castillo-Riquelme et al., 2008). According to official sources, the insurance coverage of the health system in Colombia has gradually increased, reaching near 96% of the population, one of the highest coverage rates in Latin America (Vargas et al., 2010). Out-of-pocket expenditure for health represents 17% of the total health expenditure, one of the lowest in the Latin American region (Atun et al., 2015; WHO, 2014). Although access to health care in Colombia has increased in line with insurance coverage, important inequities have been revealed not only between the two insurance regimes but also between geographical areas, urban and rural populations, social strata and ethnic groups (Garcia-Subirats et al., 2014). Activities that do not involve primary health facilities (such as vector control, mass screening, and health education) are the responsibility of governmental institutions (departmental and municipal secretaries of health) and funded from general taxation, usually without involvement of health insurers (Appendix A, Table A1), which leads to fragmentation in the delivery of these services.

Given the increasing global health interest in universal health coverage (UHC), and the noted success of Colombia's move towards UHC, we use a mixed methods approach to understand how such a policy initiative translates into practice. Specifically we explore how the health system serves those suffering from Chagas disease, a traditionally marginalised population group. We (i) estimate the actual coverage of screening, diagnosis and treatment between 2008 and 2014, (ii) identify pathways to provision of services, (iii) highlight supply-side barriers to accessing services for diagnosis and aetiological treatment, and (iv) suggest recommendations for improvement that can inform additional planned health reforms.

2. Data and methods

Access can be defined in terms of two separate components: a) *physical availability*, measured as the distribution of available inputs compared to the appropriate population denominator; and b) *effective availability*, measured by how easy it actually is for this population to obtain care (Frost and Reich, 2008). We have assessed the former (quantifying the supply of diagnosis and aetiological treatment using a quantitative approach) and investigated supply-side barriers associated with the latter (using a qualitative

approach).

Data collection from the national, departmental and municipal levels took place in Colombia between January and July 2015 across the three most Chagas disease endemic regions in Colombia (Boyacá, Casanare and Santander) as well as the capital city Bogotá. Fig. 1 gives a schematic representation of the different methods used to address the study objectives and Figure A2 shows the locations.

2.1. Quantitative approach for estimating coverage of diagnosis and treatment

2.1.1. Data sources

Comprehensive records of diagnosis and treatment coverage were unavailable. Therefore, an extensive document review of data for supply of diagnostics and therapeutics was performed. This involved collating the records of purchases and delivery of supplies for diagnosis and treatment of Chagas disease between 2008 (the official start of the national programme) and 2014. The review was conducted firstly at the national level and subsequently at departmental level (the political-administrative units in Colombia) in the three most endemic regions (For details see Appendix A, Box 1).

2.1.2. Data analysis

Coverage (measured as the physical availability and delivery of diagnosis and treatment) was calculated by comparing the registered number of screening tests (first test), confirmatory tests (second test(s)) delivered, and treatments allocated, against the most recent estimates of Chagas disease prevalence in Colombia by the WHO (World Health Organization, 2015). The total numbers of screening tests, confirmatory diagnostic tests and allocation of aetiological treatments were measured and their annual average calculated. Details about our working definition of coverage are discussed further in Appendix A, Box 2.

2.2. Qualitative approach used to explore care pathways and barriers to access

2.2.1. Data sources

We used a semi-structured questionnaire to explore care pathways and barriers for accessing diagnosis and treatment for Chagas disease. Interviews were conducted with key informants at different administrative levels of government, hospitals, research centres, NGOs, and the Pan American Health Organization (PAHO) (Table 1). Participants were sampled purposefully to ensure interviews captured insight from national, departmental and municipal levels of those responsible for the provision of Chagas care either directly or indirectly. In addition interviewees were asked to nominate other people with specific experience on the topic. Two local interviewers, previously trained on the interview guidelines and unknown to interviewees conducted, audio-recorded, transcribed, coded and compared the data.

Lastly a group of 30 people (patients, providers, EPS representatives and policymakers) were invited to participate in a structured two-day workshop called “Barriers to Accessing Care for Chagas Disease in Colombia”, where the findings of both the coverage calculations and interviews were presented and discussed. This workshop divided participants into three distinct discussion groups: i) patients, ii) providers, and iii) insurers. Each group reflected on specific experiences in the processes of diagnosis and treatment and perceived barriers to access from their group's perspective. A facilitator directed each session and an independent rapporteur took notes during the discussions. These discussions were collated into a round-table summary, which was then presented back to workshop participants and additional

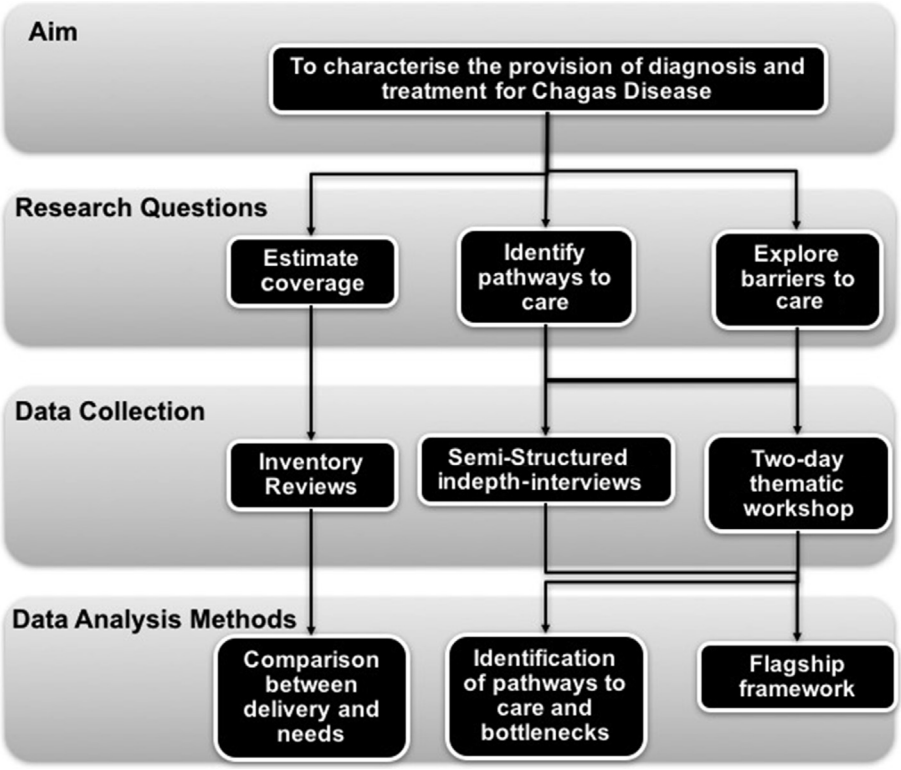


Fig. 1. Summary of aims, research questions, data collection and analysis methods.

Table 1
Characteristics of key informants interviewed.

Type of informant	National level	Departmental Level (FOAD)	Municipal Level (SOAD)	Other[a]	Total
Programme directors and coordinators	2	7	2	2	13
MD, general practitioners or Nurses	4		2		8
MD, cardiologists	2	1			2
Technicians			5		5
Microbiologists	2	1	1		4
Total	10	9	10	2	31

FOAD: First order administrative division.
SOAD: Second order administrative division.
MD: medical doctor or physician.
[a] Non-governmental organizations (NGOs) and Pan American Health Organization (PAHO).

comments were invited from the plenary group. The details of this workshop can be consulted online (DNDi., 2015).

2.2.2. Data analysis

An analysis was conducted to map the flow of patients through the health system and identify the various pathways for the provision of care. This mapping exercise was undertaken to go beyond the rhetoric of the 2011 clinical guidelines for diagnosis and treatment of Chagas disease (Ministerio de Protección Social, 2011), and reflect the health system realities and complexities reported during the interviews and workshop.

To better understand barriers to access we used a theoretical framework known as The Flagship Framework (Reich and Roberts, 2011). It is a macro-policy model that has evolved over the years and incorporates ethical, political, and policy cycle analyses (Reich and Roberts, 2011; Shakarishvili et al., 2011). The framework considers a set of "control knobs" or dimensions of a health system which policy-makers can use to achieve health system goals: (1) the *financing* domain refers to how money is raised and distributed among different services; (2) the *payment* domain refers to how the institutions or providers are paid/reimbursed and the incentives that this generates; (3) the *regulation* domain explores the set of rules for providing care between the different sectors; (4) the *organization* domain has to do with how the activities are delivered in the field, and finally; (5) the *persuasion* domain assesses the awareness of different actors in relation to their role in the system (Roberts and Reich, 2002). The basic assumption is that modifications to these dimensions will impact the intermediate objectives of access, quality, efficiency, cost, and equity in financing.

Our data were organised into two categories of interest (diagnosis and treatment) and then into a high level thematic structure based on the five 'control knobs' or dimensions. This framework has been used to contextualise access to care for Chagas disease in Mexico and the United States of America (USA), permitting international comparisons (Manne et al., 2013; Manne-Goehler et al., 2015).

3. Findings

Twelve different datasets containing data for the period 2008–2014 informed the quantitative analyses. These data included the registries for screening and confirmatory tests as well as the distribution of therapeutics at national level, which were cross referenced with registries in the three specific departments under closer scrutiny (Boyacá, Casanare and Santander). For the qualitative analyses, 31 interviews were recorded and examined across 16 institutions from all levels of the health system. Interviews lasted between 30 and 90 min. Characteristics of the interviewees are presented in Table 1.

3.1. Estimating coverage of diagnosis and treatment

3.1.1. Coverage of screening and confirmatory tests

Based on data from the blood bank national reports, a total of 5,094,417 tests were undertaken for screening of Chagas disease between 2008 and 2014, representing 100% coverage of screening in donors for this period. By contrast and for the same period, only 54,605 tests were performed across school-age children, adults and hospital-based screening. The departments of Boyacá, Casanare and Santander accounted for 85% of these screening tests. Considering that the current WHO estimate of the number of people at risk of Chagas disease infection in Colombia is 4,813,543, the coverage of screening is 1.2%. Hospitals, via insurance funds, deployed the lowest level of screening activities (4%) (Table 2).

There was no information on confirmatory tests before 2012. Since then, the number of registered people who undertook a confirmatory test compared to the total number of people with a positive first test was 82% (789/964) in 2012, 60% (585/973) in 2013, and 62% (588/953) in 2014. Using an average of 68% of confirmatory test coverage out of the total number of screened positive cases, we estimated that between 2008 and 2014, the total number of confirmed cases in Colombia was 3714 out of the 5470 screened positive cases (For details, see Appendix A, Table A2).

3.1.2. Coverage of aetiological treatment

Based on national data, the number of aetiological treatment courses released from the Ministry of Health to the departments between 2008 and 2014 was estimated to be just enough to treat 3537 cases of Chagas disease, 0.8% of the 437,960 people who are infected according to WHO estimates (World Health Organization, 2015).

When the individual registries for actual treatments allocated from the departmental level to the hospitals were reviewed in the three most endemic departments, it was found that the annual actual allocation to hospitals varied between 11% and 44% of the confirmed cases at this level (Appendix A, Table A2). Overall, it was estimated that among the 3537 confirmed cases, between 1107 and 1641 cases actually received aetiological treatment in the country between 2008 and 2014 (Appendix A, Table A3 and A4). This figure represents an aetiological treatment coverage between 0.3% and 0.4% of the total expected 437,960 cases in Colombia, according to WHO estimates (World Health Organization, 2015) (Fig. 2).

3.2. Diagnosis and treatment pathways

According to the 2011 clinical guidelines (Ministerio de Protección Social, 2011), a patient should pass through a series of stages that involve screening, confirmation and treatment. However, when the different key actors involved in these processes were asked to describe the actual pathway of patients through the health system we found that these basic three stages include a

Table 2
Coverage of screening (first test) for Chagas disease in Colombia between 2008 and 2014.

Year	Screening of population at risk (living in endemic areas or with heart complications)						Screening at blood banks
	Active screening in endemic areas				Passive screening	Total Screening of population at risk[b]	
	NHI	Secretaries of health	MSF	Research centres[a]	Hospitals[c]		
2008	3149	6292	0	654	No data	10,095	756,018
2009	5044	463	4205	0	310	10,022	692,487
2010	6854	1898	0	900	442	10,094	692,485
2011	3122	3057	2252	803	460	9694	710,825
2012	1782	0	0	0	304	2086	746,059
2013	973	4569	0	0	248	5790	740,173
2014	1728	7297	0	164	256	9445	756,370
Total	**22,652**	**23,576**	**6457**	**2521**	**2020**	**57,226**	**5,094,417**
Target						**4,813,543**	**5,094,417**
Coverage						**1.20%**	**100%**

NHI: National Health Institute; MSF: Médecins Sans Frontières.
[a] Research centres: CINTROP/UIS, Centro de Investigaciones en Enfermedades Tropicales at Universidad Industrial de Santander, Universidad del Magdalena, Universidad de Antioquia and Universidad Antonio Nariño).
[b] Blood bank screening was not included in this total as it is not aimed at identifying (screening and diagnosis) people in endemic areas but at the prevention of transfusional transmission.
[c] Adjusted for under-reporting of 50% in original data sources.

series of sub-processes that then act as bottlenecks where patients can spend months or even years before effectively continuing to the next step. Fig. 3 maps the often complex health system pathways and sub-processes patients are likely to experience.

Five possible sources for screening of Chagas disease in Colombia were identified, covering three target populations: blood donors, active school-age children and hospital-based consultations (this includes antenatal consultations). Having been screened positive, to access the confirmatory test, a patient then follows different routes according to their type of health insurance. Once confirmed as positive via both tests, the access to aetiological treatment requires several additional steps and largely depends on the distribution of drugs from the national to the local level.

3.3. Supply-side barriers to delivering and accessing care

Various stakeholders at different health system levels reflected on the barriers to accessing Chagas diagnosis and treatment. Insights are presented, with supporting quotes, organised by the five domains identified in the Flagship Framework and summarized in Table 3.

3.3.1. Financing domain

Prevention activities for Chagas disease (vector control, education and mass screening) are mainly financed through general taxation and delivered by secretaries of public health through schools or households. However, individual health care services (doctor appointments, treatments, procedures in health facilities) are mainly financed either by workers' contributions (contributive regime) or governmental subsidies (subsidised regime) that are paid to insurance companies and then delivered through public or private health facilities.

There was general consensus amongst stakeholders that this segmentation of the health system led to a lack of clarity about the specific responsibilities between public institutions (Departmental Secretaries of Health) and health insurers for ensuring the delivery of Chagas care.

Opinions differed across respondents on how the insurance type (contributive vs. subsidised) affected access. At the national level, there was mainly a perception that the two regimes were moving towards providing equal entitlement. However, most of those interviewed at departmental and municipal levels reported that patients in the subsidised regime experienced more difficulties obtaining diagnostic resources, particularly confirmatory tests:

> *"In the last five years we have identified about 200 suspected cases, patients who are positive to the first test, mostly from the subsidised regime. But, as the insurance company has not authorised the second tests, these cases have not been confirmed … "(Coordinator, secretary of health at municipal level)*

One respondent considered that inequalities in access were due to both the type of insurance and geographical provenance of the patients:

> *"People registered in the contributive regime are mainly located in cities, whereas people covered by the subsidised regime are mainly located in rural areas. Most of the health facilities are located in urban areas and it is in rural areas where the barriers to access are more concentrated …"(Physician, NGO)*

3.3.2. Payment domain

The principal method of payment for health care providers in primary care is to receive a fixed payment per patient regardless of the services delivered, also referred to as a capitation payment. According to the coordinators and directors at primary care level, this is a major resource constraint, especially when the prevalence of the disease is high:

> "*With the same amount we get paid by the insurance companies we have to deliver the complete package of care for all diseases. The resources at local level in terms of personnel, equipment, etc. are not sufficient for attending the special needs of Chagas disease patients at the primary care level or outside the health facilities" (Director, primary care level)*

All those interviewed agreed that out-of-pocket expenditure was needed to cover the costs of confirmatory tests and of transportation to attend the several visits to the doctor and receive the different procedures that are needed:

> *"Approximately, patients require eight appointments to finally receive aetiological treatment, plus the additional follow-up appointments. And, every time they go to the doctor they need to pay transportation from their villages to the city and take the day off,*

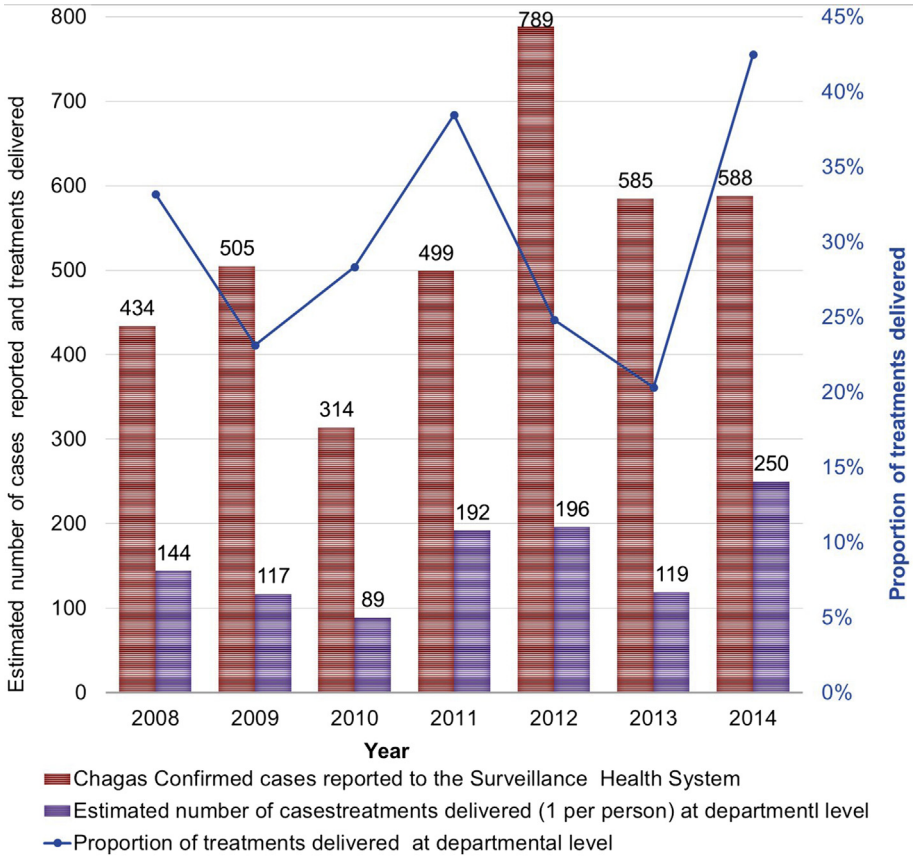


Fig. 2. Estimated number of treatments allocated from national level and actually delivered at local level against the number of confirmed cases.

which means that some patients are not able to afford the whole process of obtaining a treatment" (Technician at departmental level)

3.3.3. Regulation domain

Regulation of the health system has implications for both diagnosis and treatment at different but interconnected levels.

In terms of diagnosis, only one of the two tests needed is included officially on the insurers' list of basic authorised procedures. According to physicians and health professionals interviewed at local levels, in the majority of cases this necessitates the second test, a confirmatory test, being authorised as a special procedure by the insurance company. The exclusion of the confirmatory test in the standard package of care leads to significant delays between screening and confirmation, and it was identified as a critical problem from both care providers and programme managers:

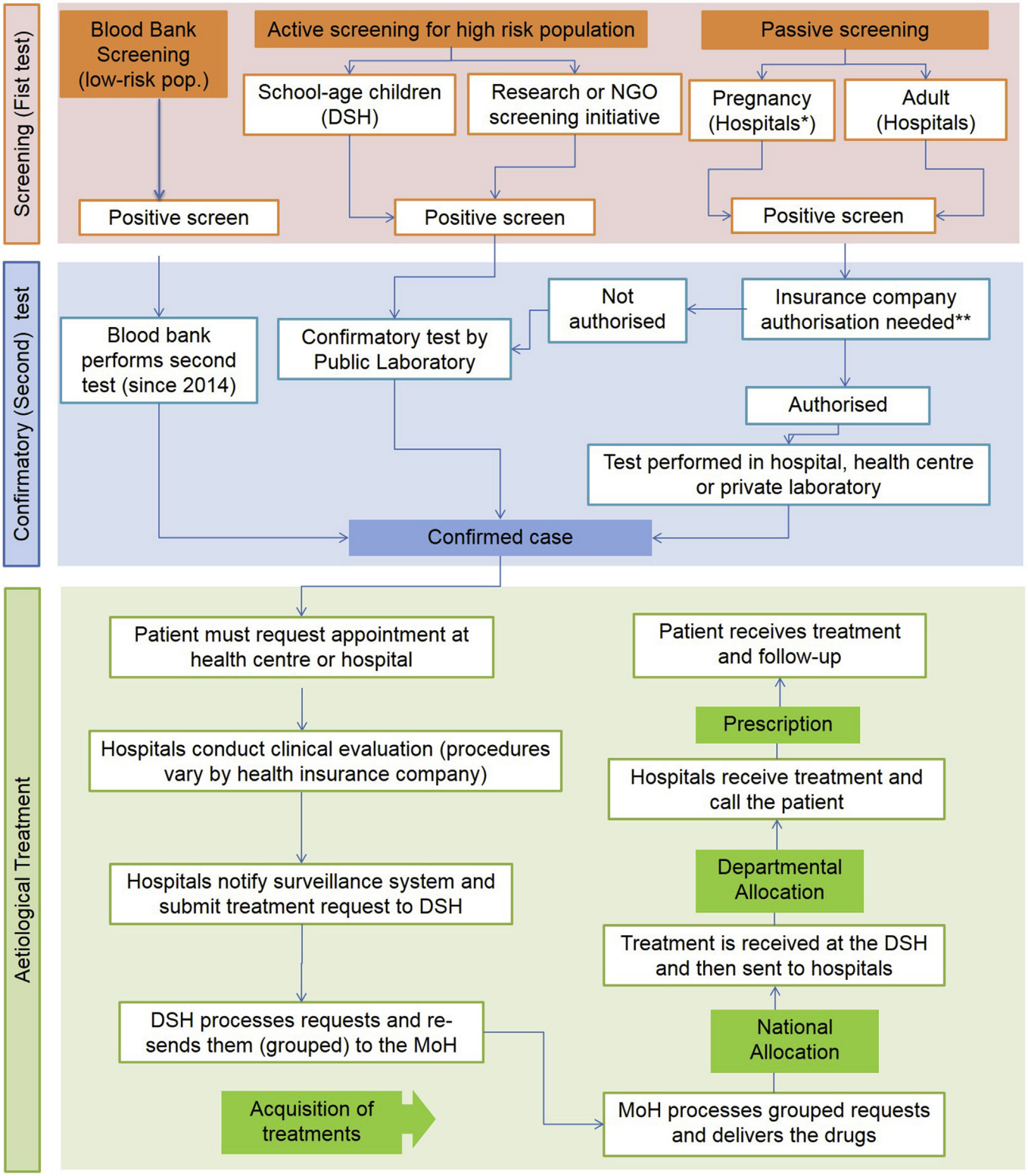
"Sometimes the results after the screening test take months to get back to us, and the patients come to the hospital looking for the result and we do not know what to say … sometimes we take samples of a pregnant woman at the beginning of the pregnancy and the result finally gets back to us when the baby has already been born" (Programme coordinator at municipal level)

Coordinators from the national and department levels reported that the confirmatory test can also be accessed through a special request to the departmental secretaries of health. Most of those interviewed at municipal level, however, suggested that such requests were either slow to process or stock was unavailable. Therefore, out-of-pocket expenditure was common for accessing the confirmatory test.

Up until 2011 blood banks - primarily private institutions designed to prevent infection through transfusion of blood components - were not obliged to perform the confirmatory test nor inform people of their potential infection status. Many infected individuals were stranded, sometimes for years, unaware of their status. In response to this, blood banks have had to inform people about their infection status (since 2011) and conduct a confirmatory test and advise patients to seek care (since 2014). According to national officials, this change in policy has not been well received by blood banks and there are still several problems with its implementation:

"The administration of the confirmatory test in blood banks is a great idea, but it means an additional cost for these private institutions, and it becomes especially costly in endemic areas where the prevalence [of Chagas disease] in donors is higher" (Coordinator at national level)

With respect to treatment, regulatory challenges extend beyond the government provision of care to include pharmaceutical regulation. Benznidazole and nifurtimox have been included in the official list of basic medicines in Colombia since 2011, meaning that in principle everyone in the country has the right to receive these treatments if needed free of charge. These medicines are recognised as part of the drugs for special public health programmes (together with those for malaria, leprosy and tuberculosis, among others). This implies that, in contrast to other diseases, acquiring, paying (in the case of Benznidazole) and distributing the drugs is an



* Only two (Arauca and Casanare) of 36 departments conduct systematic screening of pregnant women as part of prenatal control since 2012. In other departments the test is only performed under a medical explicit solicitude.
** For Contributive Regime, it needs authorisation. For Subsidised, the test is not always included
DSH: Departmental Secretary of Health; MoH: Ministry of Health; NGO: Non-governmental organisations

Fig. 3. Pathways for the provision of diagnosis and treatment for Chagas disease in Colombia.

Table 3
Supply-side barriers to delivering diagnosis and treatment for Chagas disease in Colombia.

Domain	Diagnosis	Treatment
Financing	- Segmented sources of financing: service delivery through the insurers system, and mass screening from taxation	- Annual budget depends on internal advocacy at the Ministry of Health, at central level - Nifurtimox is donated by Pan American Health Organization
Payment	- Primary care level receives payment through capitation system - Out-of-pocket expenditures related to transportation for obtaining authorisations at all levels	- Primary care level receives payment through capitation system - Out-of-pocket expenditures related to transportation for obtaining authorisations at all levels
Regulation	- Lack of licensing for some diagnostic tests - Differential access to confirmatory test according to regime (contributive vs. subsidised)	- Absence of licensing for the current drugs (benznidazole and nifurtimox) - National availability of drugs for Chagas disease is highly variable and irregular within the country, leading to times of excess supply followed by times of deficient supply
Organization	- About 30% of patients who test positive in the initial screening are lost to follow-up and remain unconfirmed due to long delays in obtaining confirmatory exams. - Confirmatory test only performed in reference laboratories - Specially challenging in remote areas and hard-to-reach populations, i.e. indigenous communities	- Treatment guidelines have not been updated - Poor logistics at organising medicine stocks at departmental and municipal levels. Personnel with poor training for treatment activities - Some supplementary tests need authorisation at the second level of care - Delays in appointments and services, particularly for populations in rural areas - Specially challenging in remote areas and hard-to-reach populations, i.e. indigenous communities

exclusive responsibility of the Ministry of Health instead of the insurance companies.

Coordinators at the Ministry of Health either receive a limited and sporadic donation of these medicines (as is the case for nifurtimox, donated by PAHO) or buy the drugs directly through the Regional Revolving Fund for Strategic Public Health Supplies—a PAHO mechanism for procurement of strategic public health supplies (Pan American Health Organization, 2006)—(as is the case for benznidazole). However, as the drugs currently do not have a national licence, every time a new importation is needed, a very complex administrative process lasting months, sometimes years, takes place. As with all pharmaceutical drugs in Colombia, the drug licensing is regulated by the Colombian National Institute of Drugs and Food Surveillance (INVIMA) (INVIMA, 2015). The application for obtaining this licence can only be made by pharmaceutical or commercial companies, but in the case of Chagas disease, interest in obtaining these permissions is low as the market is not lucrative. The only time that benznidazole was registered in Colombia was in 2006 (when it was still produced by Roche). Unfortunately, this type of permit lasts only for five years, and for benznidazole it expired in 2010 (registry 19906435). Similarly, the licence for nifurtimox (produced by Bayer) expired in 2005 (registry 42704) (INVIMA, 2015). This is an important barrier that translates into a very irregular flow of essential medicines into and within the country.

> *"We need to find a way to get the licensing registry directly by the Ministry of Health, because the pharmaceutical companies are not interested in doing all the paperwork for licensing only this very small amount of medicines we import every year" (Coordinator at national level)*

The situation described by NGOs that have conducted treatment programmes in Colombia, is in line with the previous viewpoint:

> *"When we attempted to start our Chagas treatment programme in Colombia, … we had to address so many obstacles. One of those was the lengthy approval for the treatment to enter the country, by which time the treatments had expired because of the administrative delays from governmental agencies to give clearance for the procedure. Basically, the Colombian legislation is designed almost exclusively for profit companies and not for non-profit organisations such as ours" (Coordinator, NGO)*

At the local level, the perception about treatment availability was that the drugs were very difficult to obtain and restricted to special cases.

> *"It is hard to engage the community in screening campaigns when we do not have enough treatment to offer. The availability of treatment is only for acute cases" (Technician at municipal level)*

Many of those interviewed referred to how a low number of tests performed and confirmed, a lack of incentive to import treatment and a chronic shortage of available treatment, all contributed to de-incentivise the implementation of the screening programmes and helped to maintain the status quo:

> *"I think here about half of the people who attend consultations might be infected but, as there are not available treatments, we prefer not to do the test(s) because we do not have anything to offer to the infected patients" (Physician in endemic area at municipal level)*

3.3.4. Organization domain

In terms of delivering diagnosis, screening of school-age children and pregnant women (Cucunubá et al., 2014) is, according to the Ministry of Health, a shared responsibility between the municipal secretaries of health, the departmental secretaries of health and the insurance companies in collaboration with the local communities. However, ambiguity about institutional roles and responsibilities hinders effective deployment of screening:

> *"The municipalities are willing to do schoolchildren screening but only when the national and departmental levels are actually pushing them to do it" (Coordinator at departmental level)*

> *"Screening for pregnant women is not mandatory, so it depends primarily on the interest of the local secretaries of health. Some of them conduct screening but others simply don't do it" (Coordinator at national level)*

The confirmatory test is usually an Immunofluorescence test, and requires a more complex laboratory infrastructure and expertise only available in reference laboratories in the capital city of

each department. This organisational delay was frequently identified at the municipal level:

"It would be great if a confirmatory test were available at the primary care level so the patients could obtain their diagnosis without delays. At the moment patients have to wait, sometimes months, for the confirmatory tests or they have to go on their own to the capital to obtain such a test" (Nurse, municipal level)

In terms of delivering treatment the Ministry of Health distributes the limited drug supply based on a convoluted process starting with individual requests from the departmental level (Fig. 2). All those interviewed commented on this slow process, as well as on the absence of a stock of treatments at departmental and municipal levels, leading to excessive delays. Once treatment is finally given to the patient, the follow-up procedure includes a number of supplementary tests needed for monitoring adverse effects (i.e. evaluation of liver transaminases). Some of these tests are not part of the primary care level, and hence require an additional bureaucratic procedure for their authorisation at secondary level. Such formalities translate into more delays. Delays in appointments and services are particularly prevalent for rural populations:

"Some patients make much effort to come to the secretary of health (at departmental level) and then they are not attended because they didn't have a specific previous authorisation from the municipal level or form from the insurance company. Some people get tired with all these processes" (Technician at municipal level)

As the drugs for Chagas disease are distributed through the vector-borne disease programmes, the personnel involved in these activities are more experienced with vector control activities (insecticide spraying) than with drug administration. This situation perhaps does not represent a problem for other vector-borne diseases such as malaria, where general knowledge about treatment is much more extensive, the drugs are easier to administer and there are fewer adverse effects. For anti-trypanosomal treatment, the regimens are prolonged (over 60 days) with frequent adverse effects and a need for regular medical appointments during the course of treatment:

"*In the majority of cases the only person we can have for allocating the treatments at departmental level is a technician without any clinical training, who has this as one of many other vector control activities and does not have either the time or the training for prioritising or properly distributing a limited amount of drugs. Additionally, very often [medical] doctors from endemic areas are not very familiar with the treatments, so they often call us asking for advice or guidance that on many occasions we cannot offer" (Coordinator at departmental level)*

The lack of standardised treatment guidelines for the physicians to follow was a commonly reported frustration. The first guidelines for Chagas disease treatment were officially published in 2011 and updated in 2014, but their dissemination has been problematic and resulted in a low level of implementation.

"The problem with publishing the guidelines is that they must be published all together with the guidelines for other diseases. So, as there are delays with some of them, everything is delayed"(Health officer at national level)

Diagnosis and treatment in remote indigenous communities has been largely conducted by NGOs which has posed additional challenges:

"Health personnel in indigenous communities are insufficient. They are in charge of several programmes (tuberculosis, leprosy, vaccination, mother-child care, respiratory and gastrointestinal infections, etc.). Clearly, conducting screening and treatment programmes for Chagas disease requires additional and trained personnel" (NGO coordinator)

"In the Sierra Nevada [de Santa Marta] region, there are approximately 20,000 infected people, but there is not enough treatment and capacity to treat them all" (NGO coordinator)

3.3.5. Persuasion domain

Lack of knowledge about Chagas disease and the different procedures needed to deliver treatment among professional health workers (physicians, nurses, microbiologists and technicians) was a common concern across all levels. Training workshops have been conducted in some endemic areas annually since 2000. However, given that most doctors in rural areas are recent graduates performing their required social service, continuous rotation and staff turn-over dilutes the impact of training:

"Doctors here are changed every 6–12 months, and sometimes even faster because they find it very difficult to live in these rural and remote areas. They usually do not know about these tropical diseases and their treatments" (Director at municipal level)

"Some [medical] doctors sometimes prescribe wrong doses, length of treatment, or give an inappropriate set of recommendations to patients about contraindications or other measures to be taken during treatment. We have received all sorts of enquiries about the drugs from doctors, and even though we are not doctors ourselves sometimes we have to correct them" (Coordinator at departmental level)

Additionally, in some regions, there was a perception among general practitioners that the treatment had adverse effects that could only be managed by a specialist (usually a cardiologist or infectious disease specialist), for which an appointment in Colombia can take several weeks or months to be approved:

"Sometimes the doctor tells patients that treatment is worse than the disease, so people get scared of it and prefer not to be treated" (Technician, departmental level).

Finally, several respondents suggested that funding for vector-borne diseases is mainly driven by epidemic awareness rather than by knowledge of the burden of the more chronic NTDs:

"The financial resources are insufficient. A media phenomenon drives investments [for NTDs] at the national level. For example this year it is only Chikungunya that policy makers care about. There is a marked inequality between investments for controlling certain diseases" (Physician, NGO)

4. Discussion

Despite the reported success of universal health insurance in Colombia and reported high coverage of care in Colombia, our estimates suggest coverage and access to diagnosis and treatment for Chagas disease is strikingly low. Screening coverage is estimated at

1.2% (57,226 screened out of the 4,813,543 people at risk) and aetiological treatment coverage at 0.3–0.4% (1107–1631 allocated treatments out of the estimated 437,960 infected people). While our estimates have a high degree of uncertainty, these rates are similar to those reported for Mexico and the USA (Manne et al., 2013; Manne-Goehler et al., 2015). It is important to notice that our calculations are based on an estimate of the total number of infected cases. However, as a proportion of them are in advanced chronic stage where the aetiological treatment is not indicated, the potential demand is not necessarily the total number of infected. As we do not have information about the stage of the people already treated we are not able to make a more precise estimate on the projected demand. We can assume, however, that even a more refined calculation would show coverage to be within the same low range.

We estimated that between 60 and 82% of screened positive cases received a confirmatory test and that, despite delays, aetiological treatment has been delivered to 31–44% of the confirmed cases. In endemic areas, the greatest challenge for the health system is access to a screening test, further compounded by an irregular supply of treatment.

The provision of diagnosis and treatment of Chagas disease in Colombia was identified as a complex pathway of care that combined public and private actors, without clear demarcation of their responsibilities in the health system. Barriers to access include substantial problems in the five dimensions scrutinised here. A lack of clarity in terms of financial responsibilities in a segmented health system, claims of limited resources for undertaking activities particularly at the primary care level, non-inclusion of confirmatory tests in the basic package of care, poor logistics in the distribution chain of drugs, and lack of knowledge and awareness by medical personnel were the main health system barriers identified. These problems echo the concerns of a recent evaluation of the Colombian Health Systems calling for improved accessibility and quality of health care (OECD, 2016).

The Flagship Framework is a pragmatic approach that enables policymakers and policy analysts to effectively diagnose health systems' problems and develop solutions that are dynamic and well-coordinated across the actors of the health system (Reich and Roberts, 2011). This approach is skewed to the macro-components of the supply side of the health system and potentially underemphasises the demand side and social values (van Olmen et al., 2012). Other frameworks and approaches provide additional perspectives. These include the “Building Blocks Framework” (WHO, 2007), which emphasises such aspects as health workforce, leadership and governance, and the “Social Determinants of Health” approach, which explicitly recognises that health systems are themselves social determinants for health and health equity (Marmot, 2008). However, given our supply-side focus, the limited sources of information that were available, and the use of the Flagship Framework to analyse other health systems in the context of Chagas disease (Manne et al., 2013; Manne-Goehler et al., 2015), the use of this particular framework was deemed appropriate.

The research is not without limitations. Scarcity of data when moving from the national to the departmental and municipal levels posed challenges. At times our estimates had to rely on manual searches. While these searches were conducted as thoroughly as feasible, they may have missed important information and led to underestimates at departmental level. Although we went to great lengths to identify all potential sources, it is possible that tests performed by private providers not registered through the health system have been missed. However, given the health system structure in Colombia, it is unlikely that these providers play a significant role in either diagnosis or treatment. The focus of our attention was the range of supply-side challenges associated with providing services to address Chagas disease care; however, we recognise the importance of exploring demand-side constraints. The patients' point of view is essential in understanding treatment-seeking behavior both within the formal health system and elsewhere. Several studies have looked at the patients' perspective and discussed socio-cultural aspects regarding access to care in endemic and non-endemic areas (Forsyth, 2015; Ventura-Garcia et al., 2013).

5. Conclusion

Increasing coverage and improving access to care for Chagas disease patients involves a complex network of many actors and institutions. Serious shortcomings exist in the health system for Chagas disease, despite the reported success of universal health insurance in Colombia. Specific recommendations aimed at improving access to diagnosis and treatment of Chagas disease in Colombia are listed in Table 4.

The barriers to accessing Chagas diagnosis and treatment in Colombia echo those that have been found in Mexico and the USA (Manne et al., 2012) (Manne et al., 2013; Manne-Goehler et al., 2015). The inclusion of aetiological treatment of Chagas disease is very recent in all three health systems. Yet despite their differences,

Table 4
Recommendations for improving access and coverage of diagnosis and treatment for Chagas Disease.

Domain	Recommendation
Financing	• Implement a specific and regularly updated annual budget to acquire diagnostics and medicines to help implementing large-scale screening campaigns in endemic areas in general and rural and indigenous areas in particular
	• Advocate to national and international donors to make programmes sustainable
	• Continue progress towards aligning the different health systems regimes (e.g. contributive and subsidised in Colombia)
Payment	• Introduce positive incentives (financial or non-financial) to encourage the primary care level to provide screening, confirmation and treatment
Regulation	• License benznidazole and nifurtimox, possibly in coordination with international agencies (e.g. WHO) and other countries with similar barriers
	• Include the entire set of diagnostic tests in the list of basic procedures authorised by the health system at the primary care level
Organization	• Document and publish national and subnational milestones for diagnosis and treatment, including clear demarcation of responsibilities for each actor involved in the provision of screening, confirmation and treatment
	• Publish and implement the updated guidelines of diagnosis and treatment
	• Implement a special treatment programme at municipal level in high prevalence areas, in which current infrastructure and resources are insufficient to attend an excess demand of services
	• Include mandatory screening test during pregnancy and promptly provide results and access to treatment
	• Incorporate the provision of screening and confirmatory test at primary care level. Confirmatory test might be changed from IFAT (which requires specialised laboratories) to simpler tests (e.g. ELISA using recombinant antigens)
	• Provide training at departmental secretaries of health to improve delivery of medicines to local hospitals
	• Consider installation of medicine stocks, particularly in highly endemic areas to avoid unnecessary delays
Persuasion	• Continue advocacy work with health authorities at all levels so that Chagas disease is on the agenda
	• Introduce and regularly deliver training modules on diagnosis and treatment to medical doctors working in endemic areas

the problems of providing care to patients with Chagas disease are strikingly similar and stem from both national and transnational challenges. This suggests that to successfully provide care, a more coordinated global health response is needed. This response needs leadership, with commitment from national, regional and international agencies, to help address barriers such as the timely issuing of drug import licenses. Lessons may be learned from the reported successes of addressing other NTDs such as lymphatic filariasis, and schistosomiasis (Hotez et al., 2007). Colombia was declared the first country to achieve elimination of Onchocerciasis (WHO, 2013). To repeat these successes in addressing Chagas disease will require a firm commitment from all levels of government and a coordinated, collaborative global response from international health organizations and other stakeholders.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2017.01.002.

Abbreviations

CINTROP/UIS	Centro de Investigaciones en Enfermedades Tropicales at Universidad Industrial de Santander
DSH	departmental secretaries of health
ELISA	enzyme-linked immunosorbent assay
EPS	Health promotion enterprises (Empresas promotoras de salud)
FOAD	first order administrative division
IFAT	immunofluorescence antibody test
INVIMA	Colombia National Institute of Medicines and Food Surveillance (Instituto Nacional de Vigilancia de Medicamentos y Alimentos)
MD	medical doctor
MoH	Ministry of Health
MSF	Médecins Sans Frontières
NGO	non-governmental organization
NHI	National Health Institute (Instituto Nacional de Salud)
NTD	Neglected tropical disease
NYHA	New York Heart Association
OECD	Organization for Economic Co-operation and Development
PAHO	Pan American Health Organization
RIPS	Individual Registry of Health Services (Registro Individual de Prestación de Servicios)
SIVIGILA	National Public Health Surveillance System (Sistema Nacional de Vigilancia en Salud Pública)
SOAD	Second order administrative division
UHC	Universal health coverage
USA	United States of America
WHO	World Health Organization

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