



Social tendencies of Chagas disease in the next decades

Tendencias sociales de la enfermedad de Chagas para las próximas décadas

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ABSTRACT Chagas disease is known to be the result of a complex set of bio-ecological and social determinants. The maximum incidence of the disease occurred between 1950 and 1970, with a downward tendency observed in the following decades. Innumerable socio-cultural and political elements take part in the geographic expansion of the disease, the prevention of the disease and in the medical attention given those infected. Over the next decades a major reduction in transmission is expected, especially in the vector and transfusion routes, as a consequence of control-oriented programs and changes in the production system, in conjunction with urbanization processes and extensive anthropic actions in endemic areas. A reduction in morbidity is also expected, owing to better access to the health system and to medical advances. Nevertheless, Chagas disease will continue to have great importance in the next two to three decades, the main challenges being surveillance of disease transmission and the medical attention provided to infected individuals. A reduction in the visibility of the disease, with negative repercussions in the political priority given to medical attention and disease control, is also anticipated.

KEY WORDS Chagas Disease; Social Conditions; Epidemiology/trends.

RESUMEN La existencia de la enfermedad de Chagas humana se considera el resultado de un conjunto complejo de determinantes bioecológicos y sociales. Su cumbre de incidencia se produjo entre los años 1950 y 1970, observándose una tendencia a la disminución en las décadas siguientes. Innumerables elementos socioculturales y políticos están presentes también en la expansión geográfica de la enfermedad, en su prevención y en la atención médica a los infectados. Para las próximas décadas se espera una mayor reducción de la transmisión, especialmente vectorial y transfusional, como producto de las acciones de control y de los cambios en el sistema de producción, en paralelo con la urbanización y con las acciones antrópicas extensivas en las áreas endémicas. Se espera también una reducción en la morbilidad, dependiente de un mejor acceso a los sistemas de salud y de los constantes avances en la medicina. Sin embargo, la enfermedad seguirá siendo muy importante por dos o tres décadas más, dejando como principales desafíos la vigilancia sobre su transmisión y la atención a los individuos ya infectados. Está prevista una disminución en la visibilidad de la enfermedad, con reflejos negativos en la prioridad política de las acciones sobre su atención y control.

PALABRAS CLAVES Enfermedad de Chagas; Condiciones Sociales; Epidemiología/tendencias.

INTRODUCTION

Human Chagas disease (HCD) has existed in the New World for at least nine thousand years. It is a Latin American endemic entity derived from a much older wild enzootic disease, in which the protozoan *Trypanosoma (Schizotrypanum) cruzi (T. cruzi)* moves through different ecotopes, including arthropod vectors (*Hemiptera, Reduviidae, Triatominae*) and small mammals (1-5). The disease possesses social, economic and political determinants that depend, on the one hand, on human beings' occupation of natural environments in pursuit of subsistence and wealth, and on the other hand, on poverty, anthropic activity and poor relationships of production (6). The disease has spread through internal population movements in Latin America, starting with the ancient migrations of indigenous peoples such as the Quechua, the Aztec and the Maya and intensifying during the post-Colombian European invasion (3,7). The socio-cultural and political bases of this expansion – closely linked to precarious rural housing – have been described by various authors (3,6,8,9). The epidemiological peak occurred early in the second half of the twentieth century, mainly affecting socially deprived populations in rural environments throughout the continent, from Mexico to Patagonia. Since then, changes in the production system, waves of urbanization and actions taken to control the disease (via its vector and transfusion transmission routes) have reduced the incidence, prevalence and sociomedical impact of the disease (2,10,11,12).

In this article some discernable trends or estimates of HCD for the next twenty years are explored, focusing particularly on social aspects associated with its production, expansion, medical management and control.

CURRENT PROFILE OF HUMAN CHAGAS DISEASE AND CHANGES OCCURRED OVER THE LAST THREE DECADES

The reduction in the incidence of HCD observed in the early 2010s was mainly due to vector and blood bank controls that had been intensified

since the 1970s in several endemic regions. Owing to this decline in the number of new cases as well as to the deaths of infected individuals (especially due to advanced chronic cardiopathy), there was a progressive reduction in prevalence in many regions (13,14); however, some areas of residual transmission remain in poor and uncontrolled (or insufficiently controlled) regions, for example in large areas of the South American Chaco and parts of Mexico. The two main transmitting vector species (*Triatoma infestans* and *Rhodnius prolixus*) have been virtually eliminated from many regions that formed part of the original distribution, while the proportion of blood banks under serological screening is above 95% in the majority of endemic countries. Furthermore, a reduction in congenital and transfusion-based transmission due to a decreasing frequency of infections, both in young pregnant women and blood donors, is currently observed. Similarly, in the last two decades, a decrease in HCD morbidity and mortality has been observed in many areas of the continent, especially in those that have transmission control and that offer better medical care coverage (14,15). Conversely, episodes of oral transmission have been observed in areas where wild triatomines live, especially in the Amazon region; these episodes range from 100 to 200 cases per year, although this is likely an underestimate. Another matter of concern is the intensified migration of chronically infected individuals from Latin America to non-endemic countries worldwide (2,12,15). In summary, the major epidemiological and sociopolitical changes occurring over the last two or three decades associated with HCD have been: the global evolution of the relationships and technologies of agricultural production, a strong urban-industrial trend, intensification of rural to urban and international migrations, expansion of control programs and technical advances in the medical treatment of those infected. In this vein, Table 1 shows some significant figures presented by Dr. Roberto Salvatella, including estimates by the Pan American Health Organization.

Currently, the distribution of HCD has been fundamentally reduced to the endemic areas, where mortality is still high. Moreover, it is estimated that HCD prevalence does not exceed 7-8 million infected individuals and that its incidence is even lower (14,19). In socioeconomic terms,

Table 1. Changes in the epidemiological parameters of Chagas disease in the Americas, in the years 1990, 2000 and 2006.

| Epidemiological parameters | 1990 | 2000 | 2006 |
|----------------------------|--------------|--------------|--------------|
| Annual deaths | >45,000 | 21,000 | 12,500 |
| Cases of human infection | 30 million | 18 million | 15 million |
| New cases per year | 700,000 | 200,000 | 41,200 |
| Population at risk | 100 million | 40 million | 28 million |
| Distribution | 21 countries | 19 countries | 18 countries |

Source: Salvatella (18), using estimates by the Special Programme for Research and Training in Tropical Diseases (TDR), World Health Organization.

estimates by the World Bank have shown a significant reduction in the productive days lost per year due to HCD between 1990 and 2007 (20).

The inherited and current challenges of HCD control are based in three pillars:

- a. The implementation, expansion and strengthening of vector control programs in endemic countries, including sustainable epidemiological surveillance (21).
- b. The implementation, expansion and strengthening of control programs in blood banks, which should be adequately extended to non-endemic countries to which infected individuals immigrate (12,22).
- c. The provision of medical care and social security to all those infected, including medical examinations (and treatment, if necessary) of children with seropositive mothers, even those from the most remote and isolated populations (2,23,24).

SOCIAL ASPECTS OF HUMAN CHAGAS DISEASE: EXPECTED TRENDS IN THE COMING YEARS

The most plausible timeframe for which to make future projections is over the next twenty to thirty years, considering pragmatically the natural history of the disease, the slow ecological, social and political changes occurring in endemic areas, the pace of scientific progress and the socio-political process of globalization (12,15). Traditional epidemiological parameters (transmission, incidence, prevalence, morbidity and socio-medical burden of disease) will be employed for this reflection.

Vector transmission of HCD is closely connected with the socio-cultural and political events of an endemic region (6,21). Its downward trend will continue due to control programs, extensive anthropic actions upon the environment, rural to urban migration and drastic changes in the agricultural production system. Nevertheless, the "vector/oral" routes will remain at their current levels in some areas (for example in the state of Pará in Brazil), and occasional cases may possibly appear in areas where wild triatomines are present (2,7). The primary human actions upon the environment that concern HCD are monocultures, deforestation and the construction of roads, cities and hydroelectric plants, all of which lead to a decline of native vectors in the natural environment (6,25). However, deforestation can at first function as a trigger for the invasion of artificial ecotopes by native species, primarily in search of food and shelter or attracted to the light, thus causing occasional incidents of oral transmission dependent on the vector. The phenomenon of intra-domiciliary colonization of those species is now very rare, slow and dependent on bio-ecological characteristics, because of the general lack of long periods of time for their settlement or recovery (25,26,27). In this regard, the events that took place over the last forty years in the Brazilian Amazon are illustrative: a marked tendency towards internal migration and massive deforestation caused concern among scientists and public health professionals about the incidence of new cases of HCD in the region, caused by the domiciliation of native vectors and passive transportation of alien species, particularly *T. infestans* and *T. brasiliensis* (16,26,28). Fortunately, this is not the situation at present, owing to the ecological characteristics of the area and the low

ecological valence of native vectors (15,27,29,30). In turn, certain elements of social evolution such as the urbanization phenomenon, vector control programs and progressive rural housing improvements (for example, with the introduction of gas stoves) produced a substantial reduction of introduced and secondary species in the immediate human environment (10,31). Observing the significant influence that globalization and changes in the production system have had on vector transmission, a recently published analysis highlights the following aspects (15):

- *Deforestation resulting from a strong timber market, the expansion of agro-industries and the creation of new agricultural fronts in endemic areas.*
- *Extensive use of pesticides in modern agribusiness projects.*
- *Expansion of the use of electricity and industrial machinery, influencing the behavior of vectors and rural demographics.*
- *Progressive disappearance of natural reservoirs of the parasite as a result of deforestation, pesticides and extensive monoculture.*
- *Changes in the model of production and a market dominated by economies of scale, giving priority to agribusiness rather than to the classic economic strategy.*
- *Implementation of modernization factors, especially automation, robotics and housing improvement.*

The anthropic activity exerted upon the environment tends to increase worldwide, with certain distinctive features in originally HCD-endemic areas (25,26). The searches for primary agricultural production and clean energy respond to urgent global needs that already affect and have growing significance in Latin America. Extensive food crop cultivation employing modern technology is progressing in poor and typically HCD-endemic areas such as the Brazilian Cerrado (coffee, sugar cane, and soy production, cattle ranching), the South American Chaco (soy and sugarcane production) and the arid Northeast of Brazil (sugarcane and fruit production). These activities require large foreign capital, force poor populations out of the area and reduce natural niches for vectors and reservoirs. No trend towards subsistence or a return

to the old model of family microeconomies is observed. Market demands and the political and economic determinants of globalization are the main reasons accounting for this process (15). The residual cases of vector transmission, as already mentioned, should decrease gradually, concentrating in poorer and more isolated regions of the continent, where HCD surveillance and control will remain dependent upon consistent and sustained public policies (10,21). With regard to human dwellings hospitable to vector domiciliation and HCD transmission, there has been a progressive trend towards the disappearance of huts and shacks, primarily as a result of the processes of urbanization and modernization of agricultural production. This process will be slower in micro-regions characterized by poverty such as the South American Chaco and the Northeast of Brazil. At the macro-political level, government programs for rural housing in most endemic areas are not expected to be further developed given the current trend towards urbanization, and political priorities in this regard are fundamentally linked to urban housing programs (32,33). At the epidemiological level, the primary residues of vectors tend to be concentrated in the peridomicile, which is more accessible to secondary native species and more difficult to control chemically (10,30). Keeping chickens is a common activity in rural areas, hen houses generally being the principal peridomiliary focus of triatomines. Therefore, the mass production of chickens in the context of globalization could result in a significant downward trend in the existence of hen houses in dwellings. The same applies to other domestic animals bred as a source of food for families, for example rabbits and guinea pigs (27,32).

When considering *oral transmission*, especially as a particular product resulting from the presence of infected vectors in the proximity of humans and their food, it is still impossible to predict a trend, although oral transmission is more concentrated in the Amazon region. Nonetheless, a slowly decreasing trend can be noted insofar as the industrialization phenomena progresses and food preparation practices improve (2,17,29).

As regards *transmission through transfusion*, the trend is towards virtual elimination within the short- to medium-term. The basis for this trend is

the active serological screening of blood donors, which is improving and expanding worldwide and which is reinforced by the decreasing number of infected individuals (especially young people) entering into the donor system (7,10). In Brazil, for example, from an estimated 15,000 cases of transmission through transfusion in the 1970s, at present no more than 10 cases per year (3,22) may be expected. The time will come to make a decision at the socio-political and administrative level regarding the continuity of HCD serological screening in blood banks, as large amounts of money are spent on thousands and millions of tests only to find a minimum number of infected donors (3,10,11). However, control over transfusion-associated HIV infection will remain the primary argument for maintaining rigorous surveillance (both health and epidemiological) of blood banks around the world, a practice that should continue for some decades and that benefits HCD control as well as syphilis and viral hepatitis control (11,22). In the socio-medical arena, it is necessary to improve referral of seropositive subjects to a system trained in medical care for HCD, which does not happen on a regular basis everywhere, including non-endemic countries (7,10,11,22).

Although the prevention of *congenital transmission* in medical terms is very complex, the trend is clearly towards its progressive elimination, in conjunction with the control of other forms of transmission. This can be seen in surveys of seroprevalence among pregnant women in areas with vector and transfusion

control; seropositive residues are found only in women over the age of 30 years (10,34-36). Table 2 shows the incidence of congenital cases in Brazil in 2010.

These estimates (Table 2) are not far removed from the actual situation in Brazil, as recent serological surveys of young children in the country have only exceptionally detected seropositive individuals. For example, in the last national survey, carried out in children under five years of age, only 32 serum tests were positive (0.03%) out of the nearly 105,000 tests obtained nationwide; of these, a maximum of 20 were cases attributable to congenital transmission (36). From a health care perspective, few regular and sustained programs for the diagnosis and monitoring of mother-to-child transmission still exist that offer a real chance to cure infected newborns, with exceptions in Uruguay and some regions of Argentina, Paraguay and Brazil. For treatment to rely only on the clinical detection of congenital cases is highly ineffective in public health terms, given that most cases are asymptomatic (7,35). As occurs with vector control, the tendency of health authorities is to invest less and less in health programs for congenital Chagas treatment in countries like Brazil, where its occurrence is minimal (15).

Incidence and Prevalence

Incidence and prevalence are parameters dependent on the transmission levels discussed

Table 2. Estimate of the incidence of congenital human Chagas disease in Brazil in 2010.

| Event | Number | % |
|---|-----------|--------|
| Live births | 2,920,603 | 100.00 |
| Mothers aged 15-29 ^a | 2,587,477 | 88.60 |
| Mothers aged 30-59 ^b | 332,831 | 11.40 |
| Total seropositive mothers | 7,837 | 0.27 |
| Estimated risk of transmission ^c | - | 0.60 |

Source: Own elaboration based on data from the Information Technology Department of the Sistema Unico de Saúde (DATASUS).

^aEstimated infection 0.2%: 5,174 seropositive mothers

^bEstimated infection 0.8%: 2,663 seropositive mothers

^cYearly total of 47 cases.

previously. The general trend is clearly regressive, remaining stable in locations lacking activities of control (10,24). Prevalence is additionally influenced by mortality, which becomes more significant as infected individuals age and die, including from many other chronic-degenerative causes (10,33,37-40).

Morbidity

Morbidity due to HCD refers mainly to the chronic phase, especially in terms of cardiopathies (9,41,42). Up to 10% of acute patients may die if not treated promptly, the reason for which a quick diagnosis is required. In the treatment of acute patients a larger number of parasitological cures can be offered, which result in better patient prognosis in the long term (34). Individuals in the chronic phase usually benefit from good medical care (including specific treatment when indicated), with both improved quality and increased quantity of life (9,11,34,42,43). All of these options presuppose existing medical care capabilities, especially within endemic areas with active transmission, but unfortunately the situation is much more delicate. It is recognized that medical expertise regarding HCD in Brazil and other countries is decreasing and that medical schools are generally tending to reduce the amount of academic content on the disease included their curricula (15,44). Notwithstanding, in the course of overall medical development many drugs and diagnostic and therapeutic procedures employed in the treatment of other diseases have been exploited for HCD, particularly for treating chronic heart disease, thus enabling significant advances in the clinical management of HCD. Some noteworthy examples include modern antiarrhythmics, defibrillators, angiotensin-converting enzyme inhibitors (ACE), modern surgical techniques applied to the digestive system, and increased medical indications for specific treatment (2,23,43,45).

Social and medical care

Chronically infected individuals suffering from cardiopathies or mega syndromes are the central problem in HCD medical care, because

these individuals lose both quality and quantity of life. The vast majority of these individuals are poor and depend financially, intellectually and politically on government assistance for their survival and medical care (6,33). Key issues involved in the treatment of Chagas-infected individuals can be summarized as issues of access, coverage, expertise, adherence, referral and counter-referral (45). A general effort exists to improve the medical care given to infected individuals in endemic and non-endemic countries, with support from different agencies such as the World Health Organization (WHO), the Pan American Health Organization (PAHO), and Médecins Sans Frontières (MSF). However, the training given to professionals at universities is inadequate and there is a trend towards further reduction of such training because of the progressive lack of academic interest in HCD (15). In particular, political and administrative aspects of national health systems have begun adopting different perspectives in the care of infected individuals (46). In broad terms, the trend towards health system decentralization, increasing urbanization and a relative increase in access to medical services by infected individuals can be regarded as positive events in the new millennium (15). In Brazil, for example, new social policies implemented during the last 17 years are aimed at establishing an equitable universal health care system – the Unified Health System (SUS, from the Portuguese *Sistema Único de Saúde*) – which also offers drugs and procedures free of charge to those who cannot afford them, such as the implantation of pacemakers, as well as benznidazole, amiodarone, diuretics and ACE inhibitors, among other drugs. Nonetheless, despite the improvements achieved thus far, the SUS needs to strengthen its capacity to provide quicker access and better counter-referrals and expertise, which requires government resolve and continued stimulation on the part of the scientific community (33).

Macro-political aspects and the role of the scientific community

Taking into account its principal social and geographical characteristics, HCD can be considered a problem of the State, both in endemic

and in non-endemic regions. Disease control depends on laws, political will and specific public health actions that should be adequate technically. Government actions based in the decentralization of health services and the progressive shrinking of the State – a distinctive feature of the last two decades – may turn out to be positive or negative factors in the fight against HCD, depending on their continuity and degree of coverage. However, the trend is to diminish or undermine actions of control due to lack of articulation, expertise and political priority placed on a poverty-related disease. Something similar happens in non-endemic countries, where the health care given to infected migrants is negatively influenced by their poverty and illegal immigration status (6,8). In this context, the classic approach adopted by the scientific communities dedicated to HCD is one of constant political appeals to their governments, often promoting supranational cooperation for disease control (intergovernmental initiatives) (33,46).

FINAL THOUGHTS

Within the economic, demographic and social epidemiological tendencies evolving over the coming decades, significant changes will continue to occur that will impact the disease. The displacement of infected individuals to urban centers and non-endemic countries will remain stable for a few years, with a possible long-term downward trend. Key factors of these movements are the search for employment and the deterioration of older models of rural production. Insofar as rural depopulation continues and control programs advance, the flow of infected individuals will decrease (15). The decline in domiciled vectors and the controls of blood banks will reduce the transmission and visibility of HCD, impairing in turn

the priority given to control actions, a situation that will become more serious in emergency circumstances related to other endemic problems such as dengue, hantavirus, and influenza (6,15,20). Unfortunately, the educational support for actions of surveillance and control will gradually weaken and decrease its presence in endemic areas, so it will be increasingly difficult to include HCD in formal education syllabi in endemic countries (10,12,15). At the same time, because of the strong trend towards decentralization in national health systems, actions of control and surveillance must increasingly rely on local authorities, thereby depleting the central levels (33,46). All of this is already happening in Brazil, regrettably producing a loss of data and a flagrant decrease in national references (10,13,15). On the other hand, great social and political benefits stemmed from the aforementioned intergovernmental initiatives for disease control, initiatives which involved countries from the entire endemic region and which enabled scientific and technical improvements along with an effective political cooperation among those affected (12,32). All signs indicate that infected individuals will continue to be very poor, that they will be geographically isolated or migrants, often with illegal status, and that they will remain dependent on public health services. In terms of the scientific community committed to HCD control, the situation also indicates that the motivation and interest in further research will wane, and the social emphasis placed on this endemic disease will naturally decline within international development agencies such as the PAHO and the WHO. Despite all the advances, HCD will remain a very important social problem for the next twenty years or more, as well as a source of scientific and political growth among affected countries, with additional interest on the part of some potentially affected countries such as the US (15,33,44,46-48).

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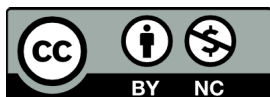
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