SOCIAL INNOVATION IN HEALTH INITIATIVE

COMPREHENSIVE HEALTH APPROACH TO FIGHT CHAGAS DISEASE

CONTINENT	Central America
COUNTRY	Guatemala
HEALTH FOCUS	Infectious Disease
AREAS OF INTEREST	Health promotion, disease prevention, cross-sector collaboration
HEALTH SYSTEM FOCUS	Community delivery

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AN ECO-HEALTH APPROACH TO FIGHT CHAGAS DISEASE, GUATEMALA

Sustainable prevention of Chagas' disease was achieved by reducing the risk of household infestation by Triatomine bugs through empowerment of communities to use locally available materials for home improvement and removal of animals from the household.

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The Social Innovation in Health Initiative (SIHI) is a global network of individuals, organisations and institutions collaborating to advance social innovation in health

This case study was prepared by CIDEIM and Universidad Icesi. Research was conducted in 2017. This account reflects the stage of social innovation at that time.

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ABBREVIATIONS

USAC	Universidad de San Carlos
WHO / OMS	World Health Organization / Organización Mundial de la Salud
JICA	Japan International Cooperation Agency (Japan)
PAHO/OPS	Pan American Health Organization / Organización Panamericana de la Salud

1. CASE INTRODUCTION

The case presented here takes place in Guatemala in Central America, a region understood to constitute a ´hot spot´ for Chagas disease (WHO, n.d). Based on the number of deaths per annum, Chagas is the deadliest parasitic disease in Latin America. It affects around 8 million people, causing an estimated 10,000 deaths each year particularly among populations living in poverty (WHO, 2017). This disease is caused by the parasite *Trypanosoma cruzi*, which is transmitted by an insect (Triatomine bug) that in Guatemala is called a *chinche*. Chagas disease is associated with conditions of extreme poverty and neglect, because the insect transmitting the parasite colonizes households in poor rural communities where cheap, readily accessible materials such as adobe, wood and palm leaves are used for construction. The insect feeds on the blood of dogs, birds, rodents, other animals and humans. It hides inside homes in crevices and cracks in adobe or wooden walls and poorly finished floors, and in roofs made of palm leaves.

The University-based project described here was initiated through research led by Dr. Maria Carlota Monroy and Dr. Antonieta Rodas, from the Laboratory of Applied Entomology and Parasitology (LENAP) at Universidad de San Carlos in Guatemala. The research, undertaken by the team from 2004, identified 17 risk factors for infestation of households by vectors. Three of these risk factors were related to the quality of the homes and were susceptible to intervention: the quality of flooring, the quality of the walls, and the presence and rearing of animals inside the homes.

The eco-health approach developed by the researchers, and backed financially by international donors including IDRC (International Development Research Centre), consists of two components: 1) the design of a strategy to fill cracks in the floors and walls using locally available materials; and 2) training of leaders and members of rural communities on how to repair and improve their own homes and to adopt the healthier practice of raising animals outside of the household. For the first component of the intervention, the team experimented with different materials and received professional guidance to identify ways of improving walls and floors. This led to finding that volcanic ash and sand provided the best mix to keep bugs from colonising homes.

The eco-health approach was implemented primarily in the department of Jutiapa, an endemic zone for Chagas disease bordering El Salvador and the Pacific Ocean. The approach has effectively reduced the rates of infestation of the Triatomine bug in the region but more importantly, it has impacted the ability of local communities to combat the disease permanently, by creating awareness about ways of reducing the risks and by training a good number of community leaders as health workers, who continued to monitor their communities after the university based team left the areas.

2. INNOVATION AT A GLANCE

Project Details

Project name	Eco-health, an integral approach to the control of Chagas Disease
Founding year	2004
Founder's name	Dr. Maria Carlota Monroy and Dr. Antonieta Rodas
Nationality of funders	Guatemala
Organisations involved	Laboratory of Applied Entomology and Parasitology (LENAP), Universidad de San Carlos
Organisational structure	Research and Action Laboratory within a private university

Innovation Value

Value proposition	Solutions to health problems must be developed according to the cultural and socio-economic context of the intended beneficiaries, involving them in each step of their implementation.
Beneficiaries	Rural populations in Guatemala and other Central American countries
Key components	Home improvement strategy (focused on improving and polishing floors and walls and better rearing of animals) to eliminate the presence of the Chagas vector, based on risk factors, with the use of local materials.

Operational Details

Main income streams	International donors such as IDRC (Canadá) and support from the Universidad de San Carlos with infrastructure and personnel.
Cost per person served	Approximately US$100 per house

Scale and Transferability

Operational coverage	Currently operating on a national scale and with occasional project based presence in other countries including México, Nicaragua, Salvador and Honduras
Local commitment	Working together with the Comapa Health Centre, Área de Salud de Jutiapa (Jutiapa Health Area), the Comapa midwives, Visión Mundial (World Vision), Ibermed
Scalability	Eco-health approach has all the elements needed and the evidence base to become a fully funded, first national and then international, strategy for the elimination of Chagas.
Sustainability	Key learnings from this approach need to be embedded into local communities, to be taken into account when building new homes and repairing existing ones. Learnings also need to be translated into an educational strategy aimed and designed at different levels and professions.

3. CHALLENGES

Chagas disease or American tripanosomiasis is a disabling and potentially fatal illness that affects vital organs such as the heart, the nervous system and the intestinal tract. It is caused by the parasite *Trypanosoma cruzi*, which is transmitted by an insect (Triatoma dimidiata). Both the Central American Region (where Guatemala is located) and the Gran Chaco region in South America are endemic zones for the illness (Solorzano, 2016). Infection may not be identified for many years, until an infected person has a heart attack in the midst of their normal activities such as cultivating their plots. The usual symptoms are not necessarily alarming (fatigue, tiredness, lack of energy) but infection leads to an enlarged heart (cardiomegaly) which can result in death (Stevens et al., 2015).

Guatemala is a country divided in 22 departments, comprising a total of 337 municipalities. The Triatoma dimidiata exists in 21 of the 22 departments and is endemic in 13. In the department of Jutiapa its presence appears to be particularly strong, according to evidence collected by the Jutiapa Health Area. Comapa appears to be the municipality most affected (Chavez, 2015).

From the second half of the twentieth century, infestation rates have remained high and levels of awareness about the disease low (Solorzano, 2016). The country has participated in various approaches to control Chagas disease, including spraying with different insecticides with allegedly controversial results, and the creation of Iniciativa de los Países de America Central para la Interrupción de la Transmisión Vectorial y Transfusional de la Enfermedad de Chagas IPCA, set up in 1997 jointly with other Central American countries and extended to Mexico in 2013 (so changing its name to IPCAM). This is a space for technical discussions about new control and prevention strategies.

From 2000 to 2014, with the financial and technical support of the Japan International Cooperation Agency (JICA), a massive spraying campaign and strategy was implemented in four Central American countries, including Guatemala. It aimed at controlling the Rhodnius prolixus and at reducing significantly Triatoma dimidiata, both insects associated with the transmission of the Chagas parasite. Rhodnius prolixus was eliminated in several countries although it still exists minimally in Nicaragua. While the infestation levels of the Triatoma dimidiata were significantly reduced, the ecological niche of the former were used and appropriated by the latter, making it necessary to expand efforts to fight the bug, which was increasingly resistant to insecticides (Solorzano 2016).

The *chinches,* as the host bug is known, feeds on blood from dogs, hens, rodents and humans, and resides (and can hibernate for up to six months) in the cracks of the walls and floors of local homes and structures (Monroy et al., 2009). For this reason, Chagas disease is associated with poverty and with often neglected and underserved populations.

4. INNOVATION IN INTERVENTION AND IMPLEMENTATION

The main element of the solution was a home improvement programme that filled cracks in the floors and walls using a mix of locally available materials, while at the same time raising awareness and training community leaders and members to repair their own homes and contribute to behavioral and cultural changes (such as rearing animals outside the homes) to eliminate the vector. Rather than attempting to control the transmission of the vector through insecticide spraying, this strategy aims at changing the cultural and physical conditions that perpetuate the problem.

Dr. Monroy, co-founder and lead of the eco-health approach to the control of the Chagas disease, recognised that trying to treat Chagas disease through spraying was not effective. Gilbert Erazo, Chagas supervisor for the Department of Jutiapa, remembers there were large numbers of the vector in many houses: "It was normal for us back in 2004 to find 100, 200 chinches per house." Dr. Monroy began to research the risk factors associated with the existence of the vector. Three factors stood out: the quality of the floor, the quality of the walls, and the presence and rearing of animals inside the homes. Addressing these three factors would make the homes "refractory," that is, immune to the occasional presence of specific bugs or to other environmental changes. This is how the home improvement programme was conceptualised, developed and initiated by the researchers, who experimented with different materials and professionals (such as architects, engineers, and environmentalists) to find ways of improving walls and floors. They realised that materials most widely available in their surroundings, such as volcanic ash and sand, provided the best mix to keep bugs at bay. Eco-friendly, local and organic materials, instead of massively produced cement, provided the solid foundations for the home improvement strategy that has been implemented ever since.

Dr. Monroy highlights four aspects of innovation with regards to the implementation of the strategy. First, their approach was based on well-researched risk factors. Having managed to identify and address three factors that are subject to changes and are related to the quality of the homes, this team was convinced that the long-term benefits of their home improvement approach would outweigh and outperform the short term gains of chemical sprayings: "By focusing on addressing risk factors, we are dealing with the root causes of this problem and not simply battling its effects," Dr. Monroy asserts.

Secondly, Dr. Monroy recognizes that working outside her professional boundaries has also been a critical aspect for their success: "From the moment we identified the three factors we were going to focus on, we started opening up our vision to consult with and include other professionals such as engineers, architects, doctors, sociologists and anthropologists. Our analysis was multidisciplinary and so was our intervention. Working across professions and disciplines wasn't always easy, but it was worth the effort." Moreover, the eco-health approach is not just multidisciplinary but also intersectoral. When a new geographical area is prioritised and scheduled for the home improvement intervention, many people interact and contribute to planning and the delivery of the strategy: a team from the national programme for the prevention of Chagas and other agents from the Ministry of Health, the health team of the regional government, public and private universities, international NGOs, and even city mayors have contributed their skills and resources. While conducting the fieldwork for this case study, three interviewees (namely Dr. Monroy, the Mayor of Comapa Mr. Estuardo Vasquez, and the Chagas supervisor for the Jutiapa Department Mr. Gilbert Erazo) all spoke of their collaborative spirit and experience.

The eco-health approach to the control and prevention of Chagas can be categorised as community-owned. This is evident in several ways. To start, the home improvement strategy respects the original design and internal space of the houses. It takes into account Mayan cultural

heritage of these designs and construction, where windows do not play a dominant role. The strategy has therefore focused on polishing and filling gaps in the walls as they are, even if they are uneven. The strategy has also emphasised the importance of having neat floors, which are polished, filled and shone with the organic, local materials that work as natural repellents. Communities own this home improvement strategy both by adapting it to the shapes and original designs of their homes and by using and exploiting local widely available materials that had previously been underused.

A fourth aspect was especially innovative. Dr. Monroy affirms that in delivering their solution, many people benefited and became ambassadors of their approach, not just executors or facilitators. This was the case, for example, for many women, and for young students who joined their laboratory as junior researchers while still undertaking their undergraduate degrees. Most have pursued careers in science and continued postgraduate degrees, but they are still closely related to the laboratory and support it in different ways. This has also been the case with many of the field technicians who were trained over the years. Laboratory staff acknowledge that their role is to train people from local communities so they can become architects of their own progress. As floors need to be repaired every 20 years, and walls need to be re-done after nine years, it is important to embed locally the abilities to mix the materials and to implement the improvements. Following this line, Belter Alcántara, field technician from LENAP, commented: "I am convinced that when this solution is owned by the communities, when they participate from preparing the materials and from doing the improvements by themselves, this solution stays there, communities can use it whenever they need to, and in this way it becomes more effective and long lasting."

Beneficiaries who were consulted and interviewed mentioned other ways in which the team´s implementation of their solution differed from other approaches: "They did not just come to teach us about the chinches and how to eliminate them by improving our homes (…) they also took blood samples, then came back with the results. To those infected they facilitated access to the treatment, and they gave them groceries so patients could recover more quickly," says Doña Cristina, beneficiary and now advocate of the home improvement programme and community leader in Almolonga, Jutiapa.

This team also assists people undergoing treatment by leveraging support from other institutions. In this regard, Dr. Monroy commented: "You can always do a little bit more for these families. Consider for example our last collaboration. We partnered with a private school in New York city. Primary students there are fundraising, so we can buy food and market provisions for patients who are undergoing treatment here in Guatemala. The medical treatment is very strong; it lasts two months, and you can only benefit from it if you are well fed."

Addressing risk factors, working collaboratively across sectors and disciplines, making sure that communities take a lead role in the preparation and delivery of the solution, preparing field technicians so they become facilitators and trainers of many more, and finally extending activities to provide stronger support to the affected communities, have all contributed to the innovativeness and effectiveness of the home improvement scheme and to the actual reduction of the Chagas vector and disease in Guatemala (Pellecer, M. et al, 2013).

5. ORGANISATION AND PEOPLE

The eco-health approach was founded and resides within the Universidad de San Carlos, at the Laboratory of Applied Entomology and Parasitology (LENAP). This institutional location helped them solidify alliances with key international donors and agencies, as the backing of a public university provides partners with reassurance and institutional trust. Internally, however, the lab team works in more organic ways. Dr. Monroy, who has led the laboratory since its inception, retired formally from the university when reaching pension age some years ago, but since then continues to work without a contractual obligation. The university provides the infrastructure and guarantees her access to undergraduate and postgraduate students, while the laboratory works on a project basis, and Dr. Monroy helps the team ad honorem in securing funds to continue with their home improvement programme and to embark on new research projects. More importantly, she supports them with her academic and writing experience, as they continue to publish articles and other type of reports arising from their research. In the last two years only, for example, Dr. Monroy has coauthored more than 26 academic articles. Dr. Antonieta Rodas, microbiologist, has also supported the laboratory from its inception. Along these two committed scientists, there has been a steady educational process, whereby more than 90 researchers, mostly women, have participated during their studies as young researchers and have then pursued careers in science.

Under the shared leadership of Dr. Monroy and Dr. Rodas, the team at LENAP understands and practices team work. At interview, several of the current researchers commented that communication flows in all directions, giving them the confidence to pose questions or discuss new ideas or findings at any time with senior members of staff. The laboratory operates with a lean budget. Everybody who is employed at any given time, on a project basis, receives a salary, and most funds raised go to the implementation and further replication of the eco-health and ecosystem approach.

Dr. Monroy emphasizes that trust holds the lab team together and this helps them build solid relationships with other institutions: *"I am convinced that everything goes down to trust. People who work for us trust what we do, they trust this approach and on how it really transforms the lives of these communities. They can see it when we visit the field. Communities also trust us because we deliver, and we accompany them. The more we visit them, the easier it gets to work with them. And trust is also what allows building up inter-institutional relationships. I can work with the Ministry of Health for example, because after many years, there is trust between us"* (Maria Carlota Monroy, Director LENAP).

5.1. COSTS CONSIDERATIONS

LENAP has been financially supported by different international agencies such as the Japan International Cooperation Agency (JICA) which donated much of the equipment the laboratory still uses, the World Health Organization (WHO), the US based National Institute of Health (NIH) and the National Science Foundation. However, the main financier of the ecosystem approach to the control of Chagas has been the International Development Research Centre (IDRC) from Canada, which in 2004 supported the idea that new control strategies, beyond chemical sprayings, were needed.

More than offering a summary of their financial history, when consulted, the team explains clearly their costings: *"It costs approximately US$100 to fully repair one house. Imagine what we could do with a $1m donation. After paying our researchers who generate new knowledge and after securing the salaries of our field technicians, who do not carry out the improvements but teach people and local communities how to do them and accompany them in the process, we could be transforming at least 8.000 homes for good. When we support one family or when we improve one house, we are improving the conditions not just for that generation, but also for the following"* (Maria Carlota Monroy, Director LENAP).

Connecting the laboratory with a primary school in New York, for example, allowed staff to start providing groceries and other goods to those patients undergoing treatment, something they could not do before. This experience has pushed staff to consider possible ways in which people not just in Guatemala but worldwide can start

sponsoring and donating to the home improvement process. Ideas for social ventures that would allow them to do that are currently being explored and could eventually contribute to the cost structure of the program.

6. OUTPUTS AND OUTCOMES

Before focusing on the impact of this programme under the lens of the objectives that all social innovations must achieve (Mulgan, 2015), some outputs and other intermediary results are discussed; these occurred as byproducts of the home improvement strategy.

Belter Alcántara, field technician, refers to one of them directly: "*When people start participating from the whole process, when they take part in every step of the home improvement program, you can notice the effect it has on their whole lives. They start showing interest and pride. They move from looking down to looking us up in the eyes. They move from the shame of having ´chinches´ in their house to invite us to enter their houses. This programme takes people out of depression and lack of hope and gives them a positive mindset*" (Belter Alcantara, Field Technician). Interviews with beneficiaries of the strategy confirmed this positive psychological impact.

As a result of visibly improving the homes, people also start organising better outdoor areas. In this regard, Dr. Monroy commented: *"As we put so much emphasis on taking the animals out of the house, people start caring more about their outsides. We´ve noticed for example that many of them planted new trees outside their houses. Many women entered fruit growing and cultivating, when they were not doing it before. They are now selling mango, papayas, nances, lemons and other fruits they did not produce before. We can say that gender empowerment through economic independence and better use of the land are also results of improving their homes"* (Maria Carlota Monroy, Director LENAP).

With economic empowerment, better use of natural resources, and stronger incomes for these families, people have enjoyed better nutrition and so better health. Another aspect of more trees outside the homes is that there is more shade, and houses are notably cooler than before. Apart from more positive mindsets, better fed children and families, and overall better conditions, other health outcomes are associated with the home improvement program. In the intervention areas, by improving the condition of the floors and moving the animals out of the house, there has been a general reduction of intestinal parasite infections in children (Stevens et al., 2015).

Geoff Mulgan (2015) affirms that all social innovations fulfil three objectives, namely: the creation of social value; the development of local skills and abilities; and overall higher levels of wellbeing.

The eco-health approach to Chagas disease has created social value by reducing the vector´s infestation rates, so reducing the levels of infections, illness and deaths associated with Chagas disease (Monroy et al., 2009; IDRC, 2014). There has also been positive cultural and behavioral change in the communities. Informing and educating rural communities on how to control the bugs by making simple improvements to their homes has led not just to the reduction of Chagas but to many community members feeling empowered and in charge of their own progress,

to higher levels of self-esteem, and to a more positive sense about the future. The home improvement programme is widespread in the Jutiapa region, and when applied to an organised community, its chances of being accepted, owned, implemented and maintained are very high, as word of mouth also plays a role in its dissemination.

There is also good evidence of the development of local skills and abilities. In Guatemala City, many young science students have benefited from joining a real research laboratory early in their careers. One current student commented: *"I came here wanting to learn about molecular biology and genetics. That happened fortunately, but here I learn also about human and sociological perspectives, for which I did not receive any training during my career. That expanded my horizons. Genetics can really have much broader implications than I thought*" (Undergraduate Student, LENAP). Local abilities have also grown in rural regions in different ways. The field technicians that LENAP hires, such as Belter Alcántara -the entry and connection points with local communities- have benefited not just from learning about health, engineering, construction, biology and agronomy but also from playing a vital, life changing role in their communities. Similarly, many of the peasant women and men who benefited from the programme have developed new skills and abilities: construction skills to improve their own floors and walls, agricultural abilities, and even entrepreneurial talents. LENAP staff suggested and taught some basic beekeeping skills to one group of women back in 2012, for example, and these women now sell honey and other products through a collectively owned business.

The higher levels of wellbeing that this innovation in health created are evident in different ways, as discussed above. According to Dr. Monroy, in 1978 there were 38,000 cases per year of Chagas disease, compared to 2000 cases documented in 2017 in the endemic zones of Guatemala. The sense of a superior purpose that the field technicians have experienced in the process of empowering and educating communities also contributes to higher levels of happiness. Feeling good and motivated about one's home and future, and finding enthusiasm after experiencing apathy, is another way in which this programme has contributed to the wellbeing of rural populations. The economic empowerment of women, and others in the community, accompanying such processes, is an added and unintended value.

7. SUSTAINABILITY AND SCALABILITY

The sustainability of the eco-health approach depends on several factors. To make it sustainable in social terms, it is important that rural builders and people in general embed the lessons about the right mix of local materials (which tend to be cheaper than industrial ones and can vary from one place to another) and knowledge about ways of polishing and maintaining floors and walls inside homes, while animals are kept outside. Other agencies present and active in the regions need to promote more actively the home improvement strategy alongside their interventions, not replacing them but accompanying them, as there are many other actors such as World Vision, Care International and the Universidad del Valle de Guatemala trying to reduce the prevalence of Chagas from different angles. For these purposes and searching for financial sustainability, the team at LENAP continues to fundraise to reach new geographical areas and to continue to accompany prior intervention communities through community events, regular visits and workshops. They also continue to build alliances, partnerships and collaborations with other agencies, as mentioned above, to embed more systematically their strategy.

Stronger capacity building, and a training and educational strategy that should be delivered at (and adapted to) different levels and at national scale, is desirable. Team members of the USAC consider themselves ready to lead this. Groups of people that could benefit directly from this

strategy should include science students, community and social workers, anthropologist and sociologists, health professionals at all levels, public health policy makers, workers of NGOs, government officials such as majors and governors, local schools staff and teachers, among many others.

In terms of scale, this approach has already been replicated by the project team in other countries such as México, Honduras, Salvador and Nicaragua. According to an IDRC Report from 2014, *"the home improvements have led to dramatic decline in infestation rates of T. Dimidiata. In Guatemala, house infestation declined by a factor of four in participating communities, while in study sites in Honduras, the vector was completely eliminated from households (…) In less than 18 months, almost 70% of medium to high-risk houses were improved, with further work still underway in El Salvador"* (IDRC, 2014). Dr. Monroy has estimated that to 2018, the programme has improved 8000 homes in Central America from its beginning, most of them in Guatemala, benefiting approximately 40,000 people. Despite these numbers, the project team considers that the levels of diffusion could be higher, but Chagas in still a neglected disease that does not break into TV news. The variations in the availability of raw materials also plays a decisive role in levels of diffusion. In Nicaragua, for example, the materials exist, but they are at a deeper level underground, and therefore it is more expensive to access them.

The home improvement strategy and the ecosystem focus could be shared and adapted to the availability of local materials and to local conditions in every country where Chagas is a problem. But the leaders warn us, based on their experience:

"Success for this approach depends on how organised a community is and what levels of trust there are between the communities and the champions of this approach. If a community is fragmented, disorganised, failure is guaranteed. If we don't take time to select carefully which person is a trusted messenger in each community, this doesn't work" (Interview with Dr. Monroy)

8. KEY LESSONS

This team is welcomed in rural areas where they have intervened, and this is testimony to the fact that the strategy has changed the lives and perspectives of their intended beneficiaries. Some messages that emerge from this case study offer insights for anyone working on neglected diseases or other diseases of poverty:

- Health interventions should address risk factors and not focus on effects. When the attention is given to the root causes of health problems, chances of solving them become real, outperforming palliative responses.
- Communities need to be approached with respect, and their culture must be taken into account. Field workers and technicians have to be accepted and trusted by communities, and they should preferably come from those same areas, as they function as knowledge brokers between research laboratories and rural inhabitants. Once the information is widespread, local people must own the techniques, so they can implement them by themselves and repeat them as needed.
- Interventions are more effective when they involve multiple disciplines and when they are designed to function across sectors. Working in isolation as a researcher, or as the sole possessor of a strategy as a team, will not resolve health problems at a large scale.
- Effective health interventions tend to unleash other positive dynamics, such as empowering community members and identifying

new income streams that emerge as a result of learning new skills and enjoying a better health.

• Creativity needs to be called upon in terms of proposing new ways of funding these participatory approaches. The eco-health one, well designed and concrete in nature, is not necessarily expensive, and consequently its scope and impact could be multiplied, benefiting thousands more.

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