Engaging the public in support of Area-wide Integrated Pest Management

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Area-Wide Management of Insect Pests: Integrating the Sterile Insect and Related Nuclear and Other Techniques
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Content

1. Central American Chagas disease control initiative and sustainability challenges
2. Implementation of Area-wide Integrated Vector Management to control Chagas disease
3. Lessons learned in Area-wide IVM
Chagas is a deadly disease that affects vulnerable populations in Latin America

- 9 million infected with *Trypanosoma cruzi*
- Silent chronic disease
- Transmitted by triatomines infesting houses under extreme poverty conditions
Chagas disease is mainly transmitted by vectors

- Vector-borne: >80%
- Blood: 16%
- Congenital: 2%
- Other routes: <1%
- (i.e. oral, organ transplant, laboratory accident)
The Central American initiative focused on interruption of vectorial transmission

- October 1997
- Interrupt transmission by *Rhodnius prolixus* and *Triatoma dimidiata*
Chagas disease vector control was prioritized by JICA in Guatemala
(Annual meeting CA initiative, 1999)

- 4 million at risk
- Prevalence: 9.8/100 inhabitants
- Annual incidence: 28-30 thousand cases
- >1,500 new cases/year

Tabaru et al. 1999
Chagas disease vector control programs are based on insecticides and house improvement

- Indoor residual pyrethroid formulations
- Surveillance
- Community participation:
  1. Surveillance
  2. House improvement
  3. Health education
Vector control sustainability is a challenge to the interruption goal

1. Insecticide cost ($10/house)
2. Insecticide resistance
3. Sylvatic or peridomestic vectors
4. Slow house improvement process
5. Loss of political will
*T. dimidiata* control is a challenge in Guatemala

Focalized persistent *T. dimidiata* infestation after insecticide-based control

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Our objectives:

1. Improve Chagas disease prevention through an improved understanding of ecological, biological and social determinants of persistent vector infestation

2. Develop and evaluate a community-based and intersectoral intervention for peridomestic animal management to reduce vectors in human habitats
A multidisciplinary project
pre-proposal

1. MoH epidemiological data
2. Central area MoH administrative support
3. Local area MoH support
4. Multidisciplinary proposal
Our strategy is multidisciplinary.
Our strategy is iterative

PRECEDE: SITUATIONAL ANALYSIS

Phase 1: Social Assessment
Phase 2: Epidemiological Assessment
Phase 3: Behavioral and Environmental Assessment
Phase 4: Educational and Ecological assessment
Phase 5: Administrative Policy Assessment
Phase 6: Implementation
Phase 7: Process evaluation
Phase 8: Impact evaluation
Phase 8: Outcome evaluation

• Health Services
• Health Education
• Health Promotion
• Policy, Regulation

Predisposing factors
Enabling factors
Reinforcing factors

Behavior and lifestyle
Environment:
Vector and reservoir distribution
Quality of life: reduce Chagas disease transmission

PRECEED: INTERVENTION
Phase 5: Administrative Policy Assessment
Phase 4: Educational and Ecological assessment
Phase 3: Behavioral and Environmental Assessment
Phase 2: Epidemiological Assessment
Phase 1: Social Assessment

PRECEDE: SITUATIONAL ANALYSIS

Quality of life: reduce Chagas disease transmission
Phase 1: Social assessment

• Establish rapport with communities

• Presentations to authorities, communities, municipal leaders

• Socioeconomic case study
Phase 1: Social Assessment

Phase 2: Epidemiological Assessment

Phase 3: Behavioral and Environmental Assessment

Phase 4: Educational and Ecological assessment

Phase 5: Administrative Policy Assessment

PRECEDE: SITUATIONAL ANALYSIS

Quality of life: reduce Chagas disease transmission

Vector and reservoir distribution
Phase 2: Situational Analysis
Diagnostic of eco-bio-social context and risk factors

Rats are infected and associated with persistent *T. dimidiata* infestation
Phase 5: Administrative Policy Assessment

Phase 4: Educational and Ecological assessment

Phase 3: Behavioral and Environmental Assessment

Phase 2: Epidemiological Assessment

Phase 1: Social Assessment

PRECEDE: SITUATIONAL ANALYSIS

Behavior and lifestyle

Environment:

Quality of life: reduce Chagas disease transmission

Vector and reservoir distribution
Participatory meetings

1. Food storage practices, natural resources

2. Land ownership, animal management, production systems
   - Chagas disease

3. Chagas history in the area, identifying key players and roles, local challenges, expectations
We implemented a Participatory Action Research approach

• Communities actively participate in proposing solutions
• Iterative process of reflection and action

Bustamante et al PLOS One, 2014
PRECEDE: SITUATIONAL ANALYSIS

Phase 5: Administrative Policy Assessment

Phase 4: Educational and Ecological assessment

Phase 3: Behavioral and Environmental Assessment

Phase 2: Epidemiological Assessment

Phase 1: Social Assessment

Predisposing factors

Enabling factors

Reinforcing factors

Behavior and lifestyle

Quality of life: reduce Chagas disease transmission

Vector and reservoir distribution

PRECEDE: SITUATIONAL ANALYSIS
Phase 4: Situational analysis
Ethnography

Anthropologists lived for one month in selected communities
- Housing construction practices
- Household economic activities
- Agricultural and animal management practices
PRECEDE: SITUATIONAL ANALYSIS

Phase 5: Administrative Policy Assessment
- Health Services
- Health Education
- Health Promotion
- Policy, Regulation

Phase 4: Educational and Ecological assessment
- Predisposing factors
- Enabling factors
- Reinforcing factors

Phase 3: Behavioral and Environmental Assessment
- Behavior and lifestyle
- Environment:

Phase 2: Epidemiological Assessment

Phase 1: Social Assessment
- Quality of life: reduce Chagas disease transmission
- Vector and reservoir distribution
Phase 5: Situational analysis
Stakeholder map and policy analysis
Our hypothesis:

- Rodent nests maintain a constant source of infestation and transmission in the house
- If rodent nests are reduced, transmission should also be reduced
We chose a cluster randomized cohort study design.

Distribution of communities selected for the study intervention 2012-2013

- Red: Intervention
- Blue: Control
- Orange: Infestation levels <15%
Our Intervention: Healthy environments for Chagas disease control

Indoor residual insecticide + Education Participation + Environmental Management = Chagas prevention
Phase 1: Social Assessment

Phase 2: Epidemiological Assessment

Phase 3: Behavioral and Environmental Assessment

Phase 4: Educational and Ecological Assessment

Phase 5: Administrative Policy Assessment

Phase 6: Implementation

Phase 7: Process Evaluation

Phase 8: Impact Evaluation

Phase 8: Outcome Evaluation

PRECEDE: SITUATIONAL ANALYSIS

Quality of life: reduce Chagas disease transmission

Vector and reservoir distribution

Phase 1: Social Assessment

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Phase 8: Outcome Evaluation

PRECEDE: SITUATIONAL ANALYSIS
We chose a community-based participatory strategy

- 9 Participatory activities
- Education, reflection and discussion of risk factors and the disease
- SWOT analysis
We chose a community-based participatory strategy

• Combined bottom-to-top and top-to-bottom strategies
• Vector personnel supervised community volunteers to spray insecticide
We chose a community-based participatory strategy

• We taught participants to use mechanical rodent traps and effectively reduced rodent infestations

• Participants tested different trap designs to ensure adoption

We chose a community-based participatory strategy

Intersectoral environmental management to reduce rodent infestations

We chose a community-based participatory strategy

Our intervention achieved sustainable vector control levels

Significant difference, GLMM p<0.05

“I feel happy because... we respect life by taking care of our health and preventing a deadly disease”

(R1, comunidad 3, sept. 2012)
Our strategy is iterative

PRECEDE: SITUATIONAL ANALYSIS

Phase 5: Administrative Policy Assessment
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• Health Services
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Phase 6: Implementation
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Predisposing factors
Enabling factors
Reinforcing factors

Behavior and lifestyle
Environment:

Quality of life: reduce Chagas disease transmission
Vector and reservoir distribution

Our strategy is iterative
What is the importance of congenital Chagas disease?

• 1% seropositive children in 2015
• 10% seropositive women of child-bearing age in 2015

• We have started a program with midwives to refer pregnant women and their newborns for neonatal screening

Pennington et al submitted
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Complex socioeconomic problems need multidisciplinary approaches

- Use an iterative process
- Combine bottom-up and top-to-bottom strategies
- There is no single magic bullet
- Use all the tools in the toolbox!

(Green and Kreuter 2005, as cited by the University of Kansas 2012)
Understand the needs

- A participatory process is more than education, it leads to empowerment
- Participants propose solutions
- Participants are your collaborators and your champions
- Listen carefully!
Understand the community

• Map stakeholders
• But, be aware that the recruitment process will affect the end product
• Ex. house-to-house processes will produce gender bias
• Involve leaders as participants, not only supporters!
Conclusions

1. Persistent *T. dimidiata* infestation associated with peridomestic rats threatens Chagas disease transmission interruption in Guatemala

2. Our Integrated Vector Management Program is more sustainable than vertical insecticide-based control

3. Iterative, participatory, multidisciplinary processes can sustain relevant disease control
Future IVM studies: Sterile Insect Technique for malaria elimination

• 1970s, USDA/CDC released chemosterilized males of *Anopheles albimanus* in El Salvador

Lowe et al 1980
Potential SIT application in malaria elimination

- Guatemala 4,000 malaria cases in 2014
- Focalized to sites with sugar cane water reservoirs and coastal tourist areas
- **SIT: “An alternative that must be carefully evaluated”** - MoH Vector Control Program Officer
Collaborators

UVG
- Sandra De Urioste-Stone (Natural resource management)
- Celia Cordón (Biology)
- José Guillermo Juárez (Biology)
- Hugo Perdomo (Microbiology)
- Hugo Enríquez (Mastozoology)
- Nancy Sandoval (M.D.)
- Elizabeth Pellecer (International development)
- Jorge Sincal (Technician)
- Edgar Pereira (Social scientist)
- Teresa Aguilar (Development specialist)
- Andrés Álvarez (Anthropology)

Ministry of Health
- Dra. Elsa Berganza (Epidemiologist)
- Ranffery Trampe (Vector control)

CDC
- Joe Bryan (Congenital Chagas and Zika)
- Ellen Dotson (Chagas and Malaria)

Communities
- COCODES and communities of Comapa and Zapotitlán
Indoor residual insecticide + Education Participation + Environmental Management = Chagas prevention

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