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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CENTRO DE ESTUDIOS EN SALUD
INSTITUTO DE INVESTIGACIONES
UNIVERSIDAD DEL VALLE DE GUATEMALA

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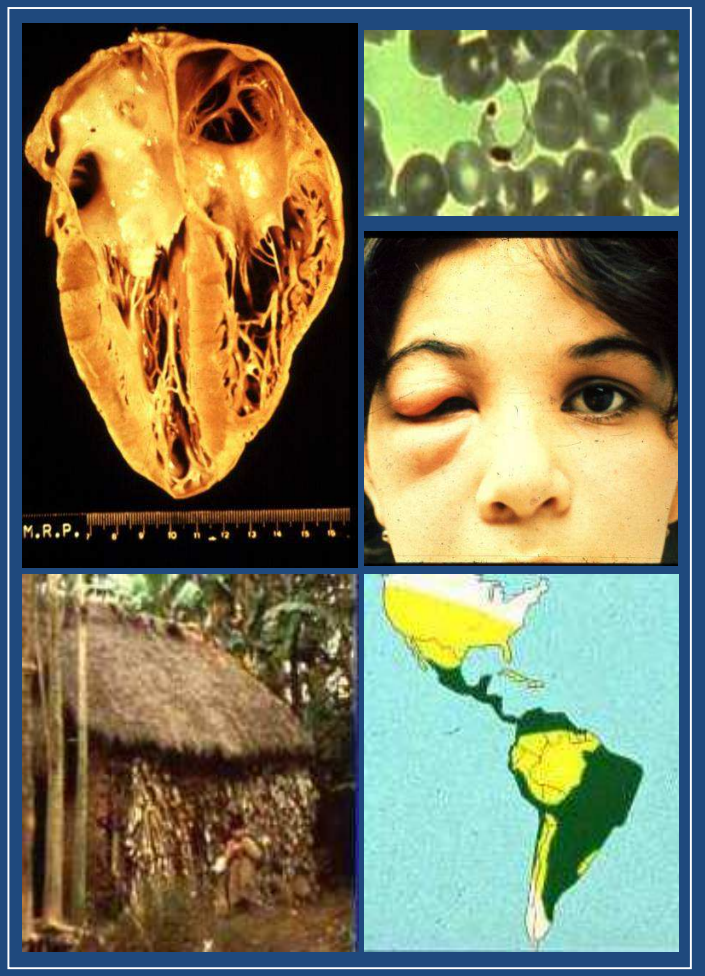
CENTRO DE ESTUDIOS EN BIOTECNOLOGÍA
INSTITUTO DE INVESTIGACIONES

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



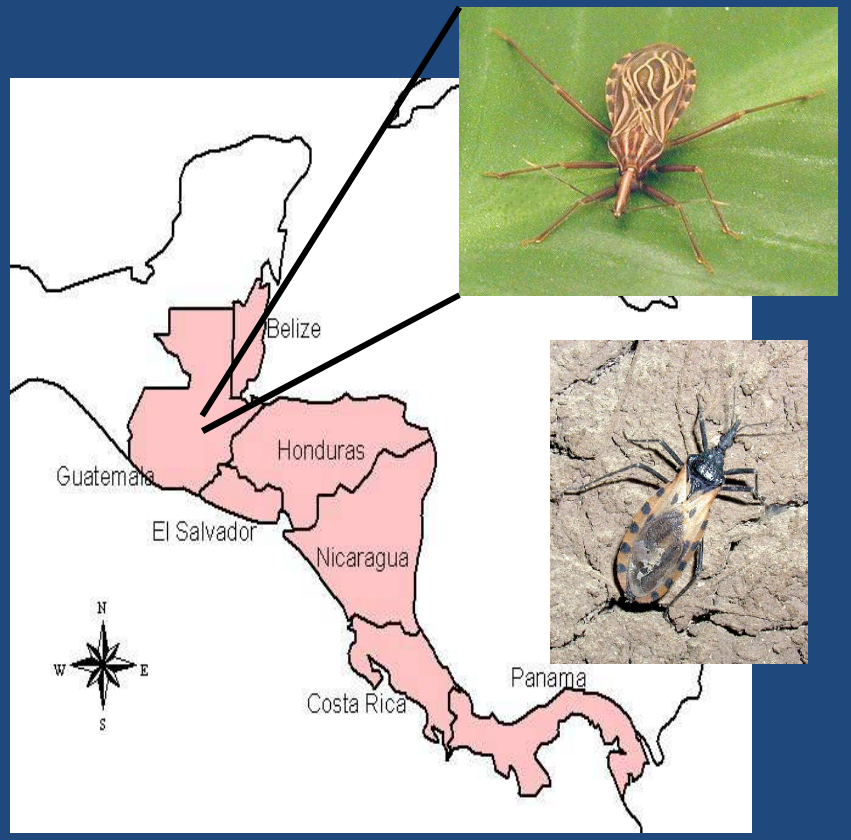
Chagas disease is mainly transmitted by vectors



- 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

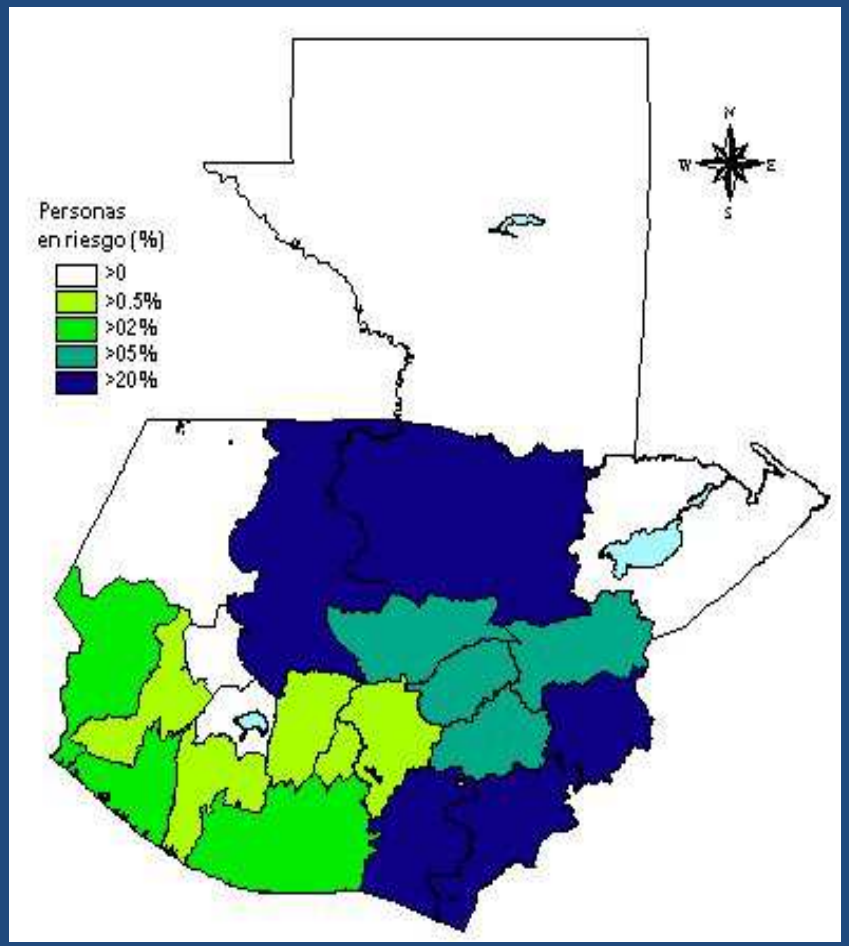
- October 1997
- Interrupt transmission by *Rhodnius prolixus* and *Triatoma dimidiata*



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

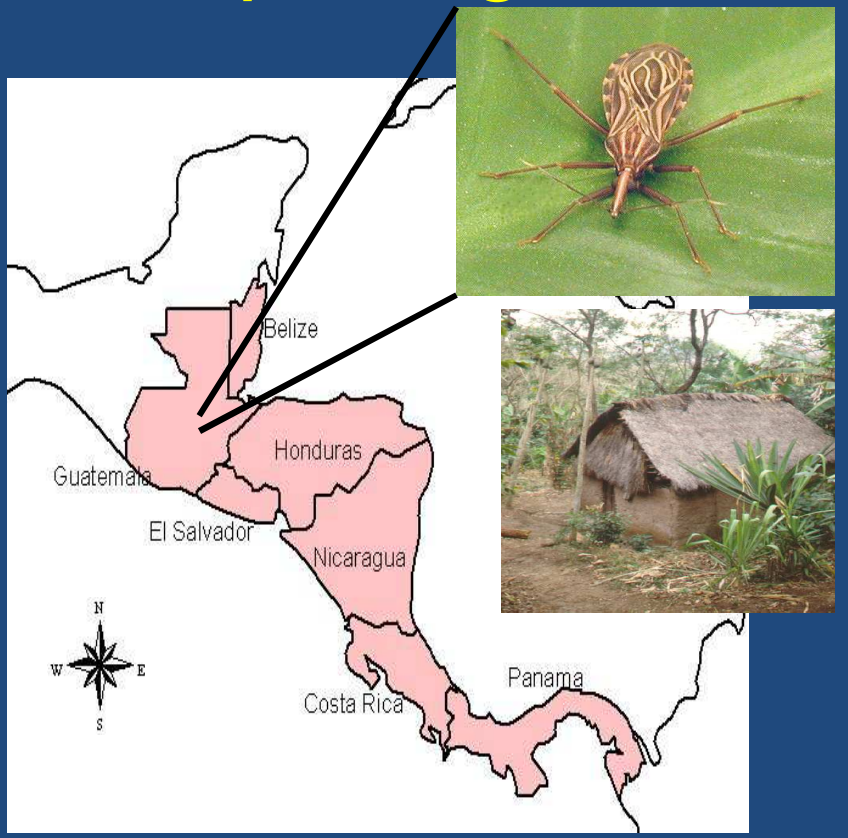
Chagas disease vector control programs are based on insecticides and house improvement

- Indoor residual pyrethroid formulations
- Surveillance
- Community participation:

1. Surveillance
2. House improvement
3. Health education

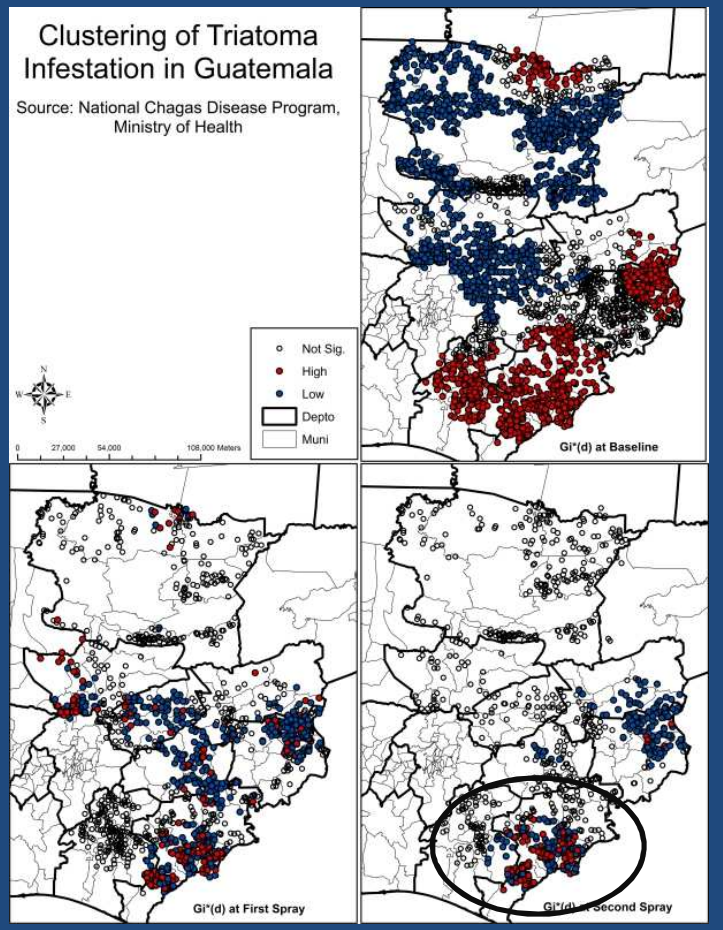
Vector control sustainability is a challenge to the interruption goal

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



Manne et al 2012 doi: 10.4269/ajtmh.2012.11-0052.

Content

1. Chagas disease Central American control initiative and sustainability challenges
2. Implementation of Area-wide Integrated Vector Management
3. Lessons learned in Area-wide IVM

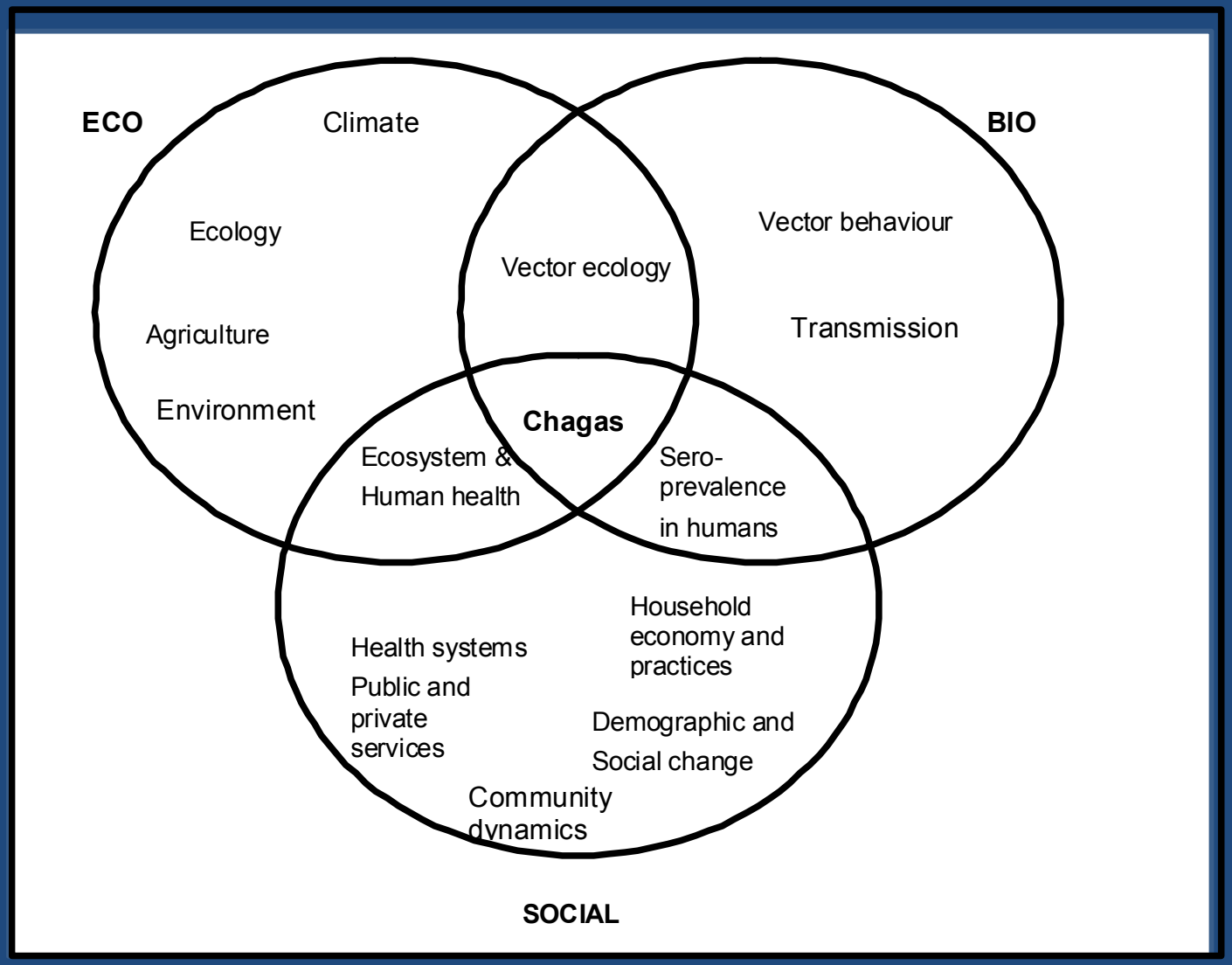
Our objectives:

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 5: Administrative Policy Assessment

Phase 4: Educational and Ecological assessment

Phase 3: Behavioral and Environmental Assessment

Phase 2: Epidemio-logical Assessment

Phase 1: Social Assessment

- Health Services
- Health Education
- Health Promotion
- Policy, Regulation

Predisposing factors

Enabling factors

Reinforcing factors

Behavior and lifestyle

Environment:

Quality of life: reduce Chagas disease transmission

Vector and reservoir distribution

Phase 6: Implementation

Phase 7: Process evaluation

Phase 8: Impact evaluation

Phase 8: Outcome evaluation

PROCEED: INTERVENTION

PRECEDE: SITUATIONAL ANALYSIS

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Quality of life: reduce Chagas disease transmission

Phase 1: Social assessment

- Establish rapport with communities

- Presentations to authorities, communities, municipal leaders

- Socioeconomic case study

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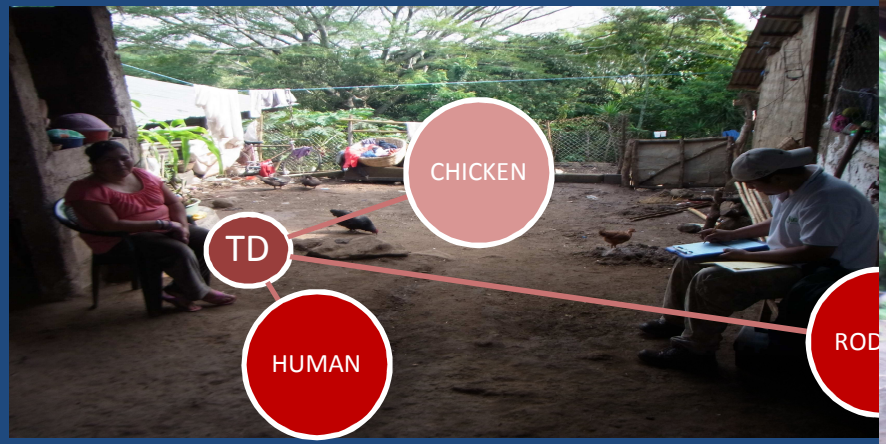
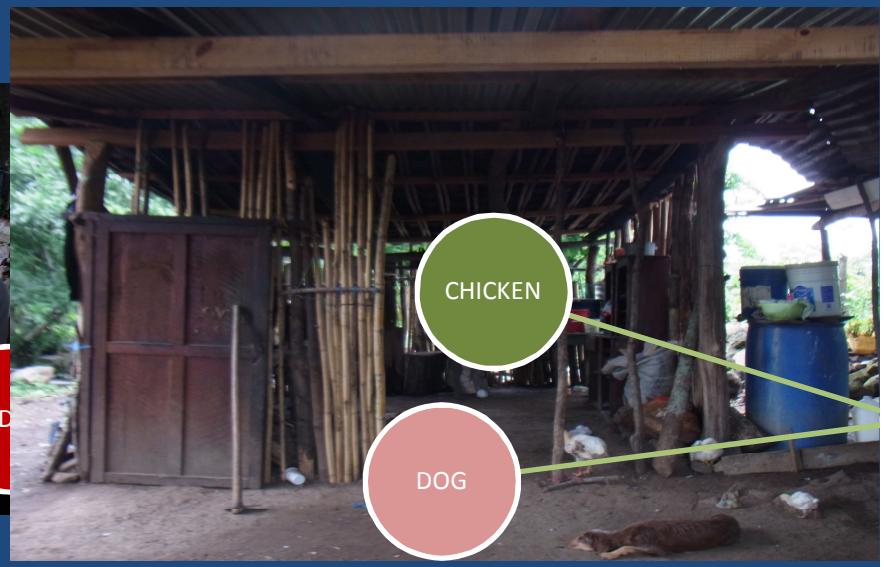
Quality of life: reduce Chagas disease transmission

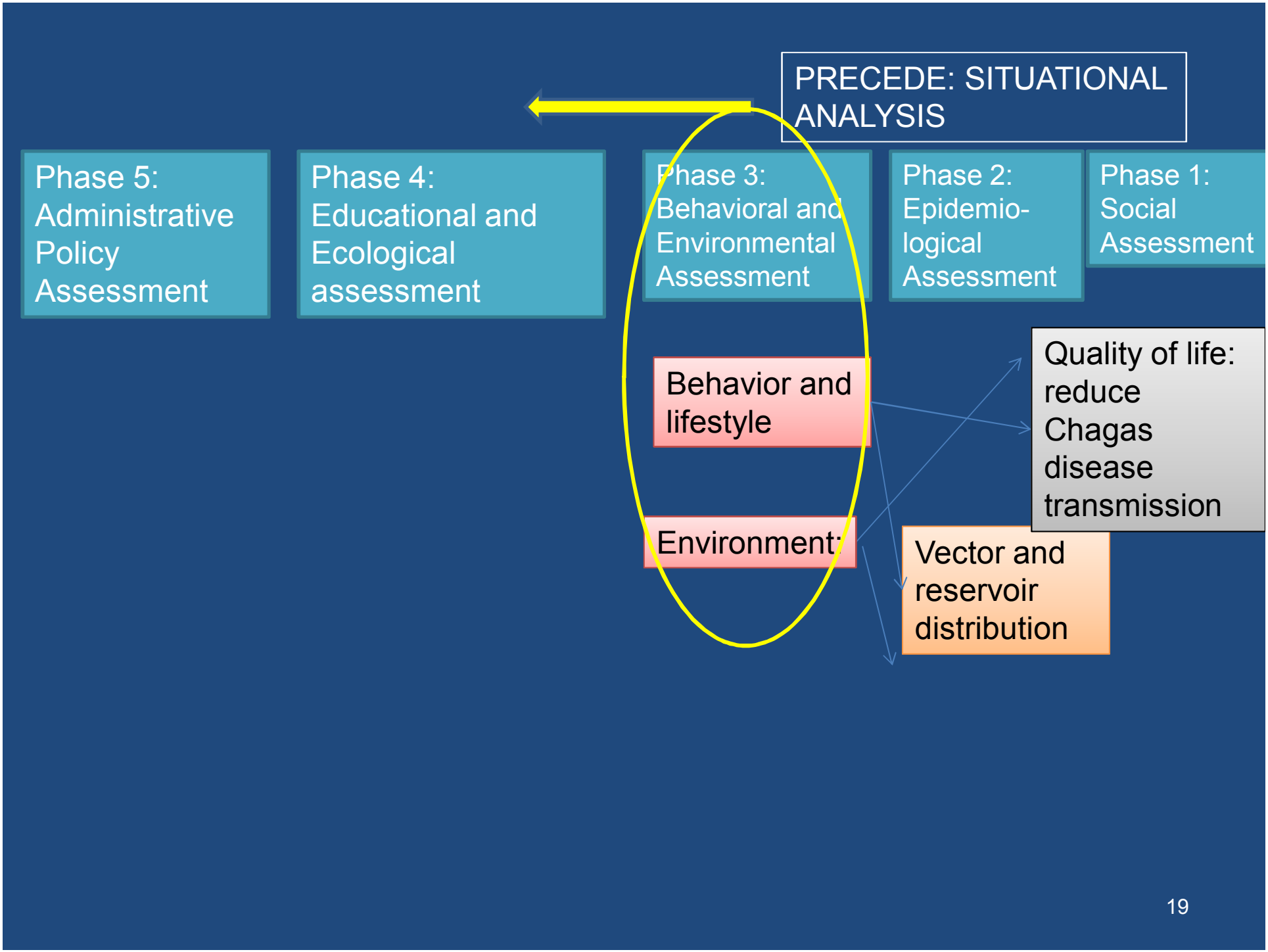
Vector and reservoir distribution

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





Rats are infected and associated with persistent *T. dimidiata* infestation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Environment
Quality of life: reduce Chagas disease transmission
Vector and reservoir distribution

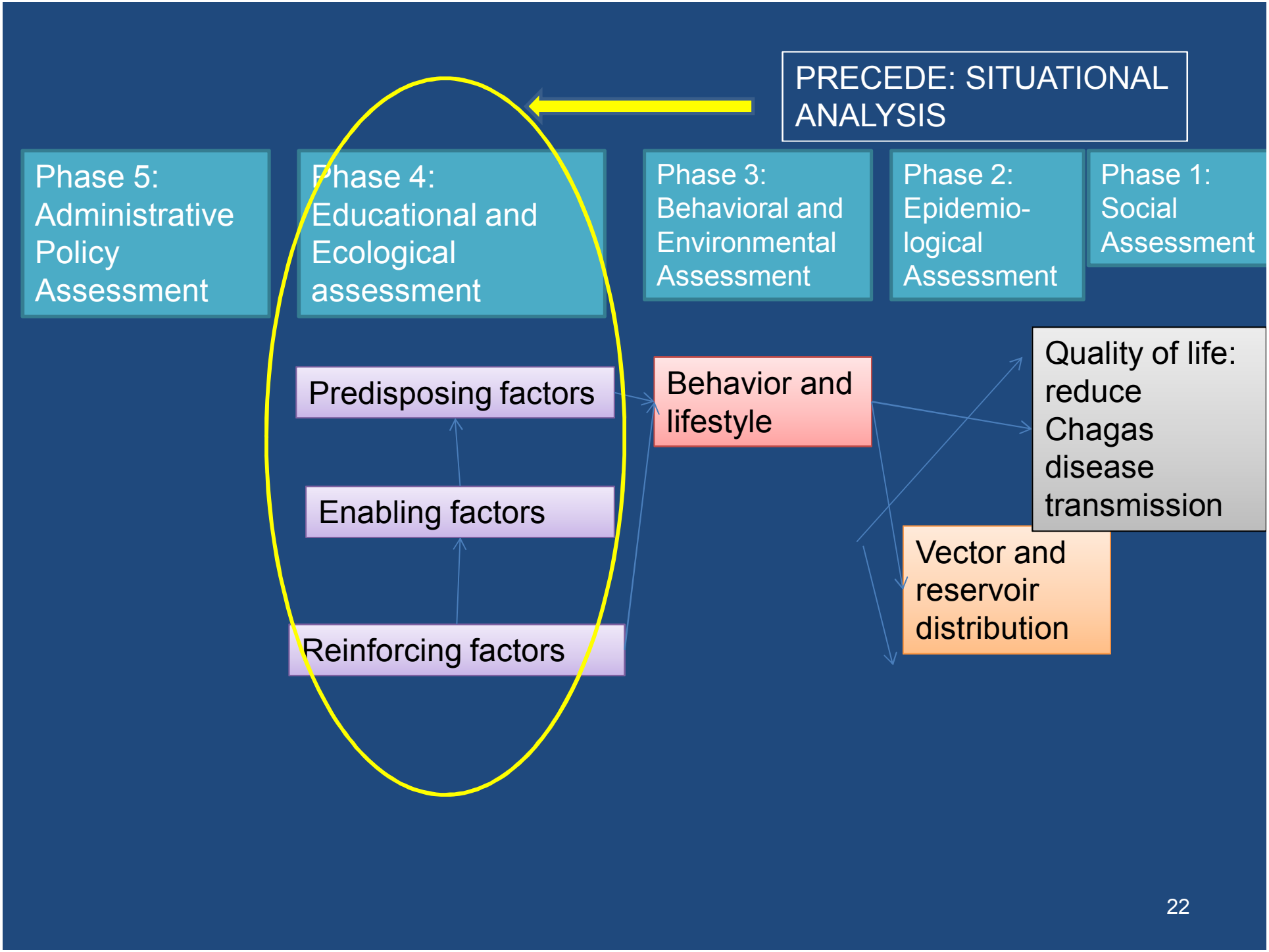
Participatory meetings

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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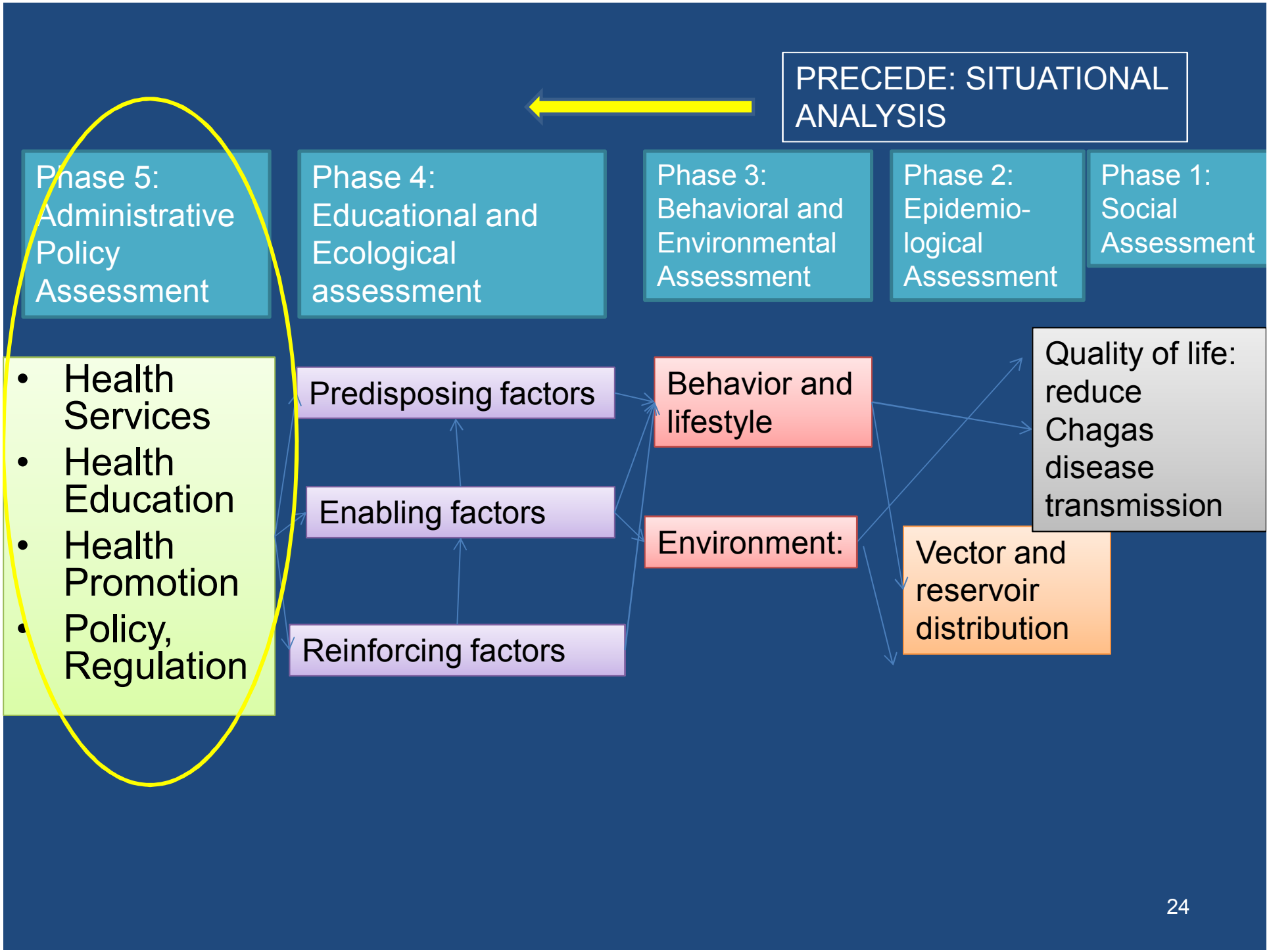
Phase 4: Situational analysis Ethnography

Anthropologists lived for one month in selected communities

- Housing construction practices
- Household economic activities
- Agricultural and animal management practices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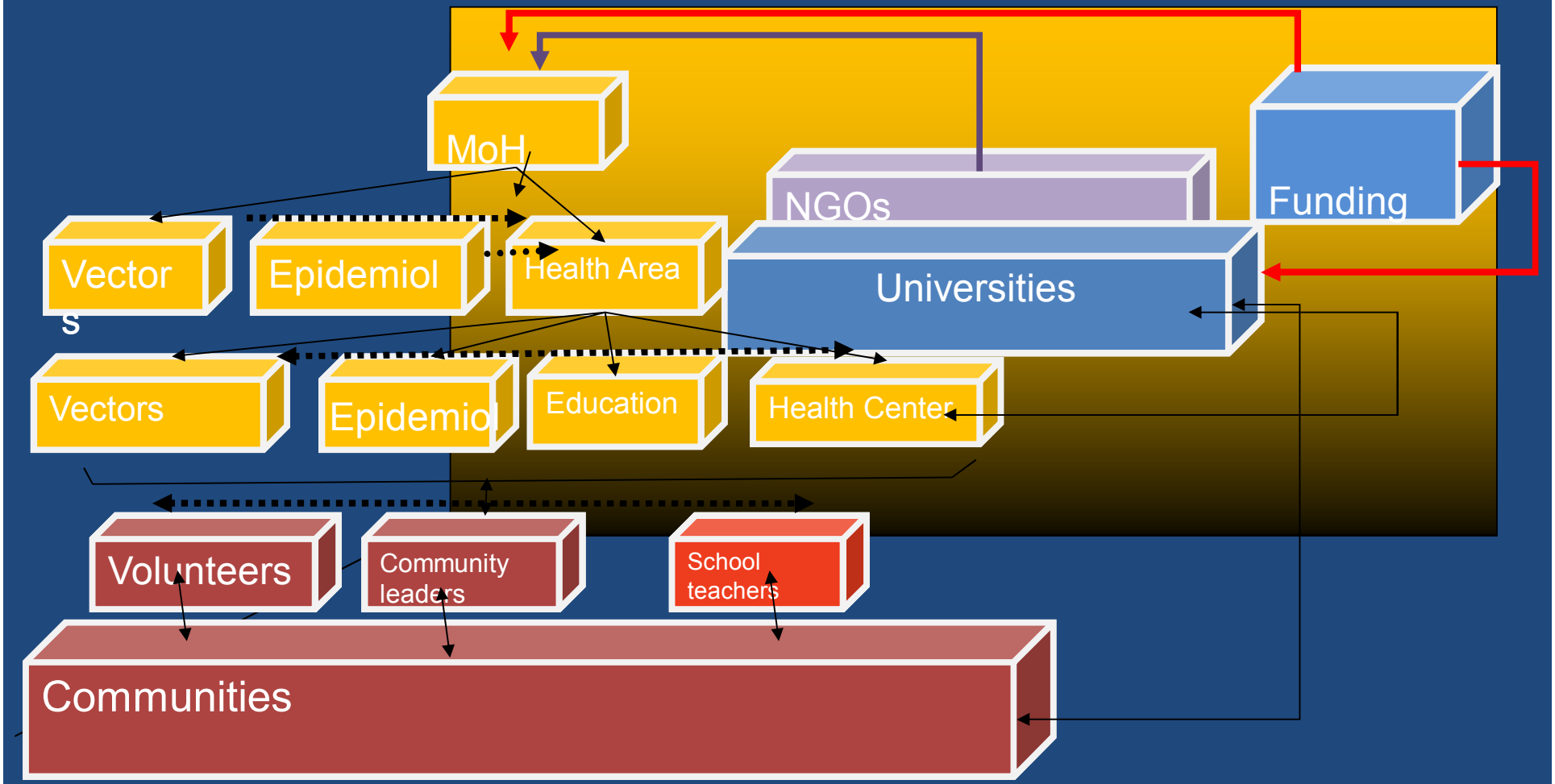
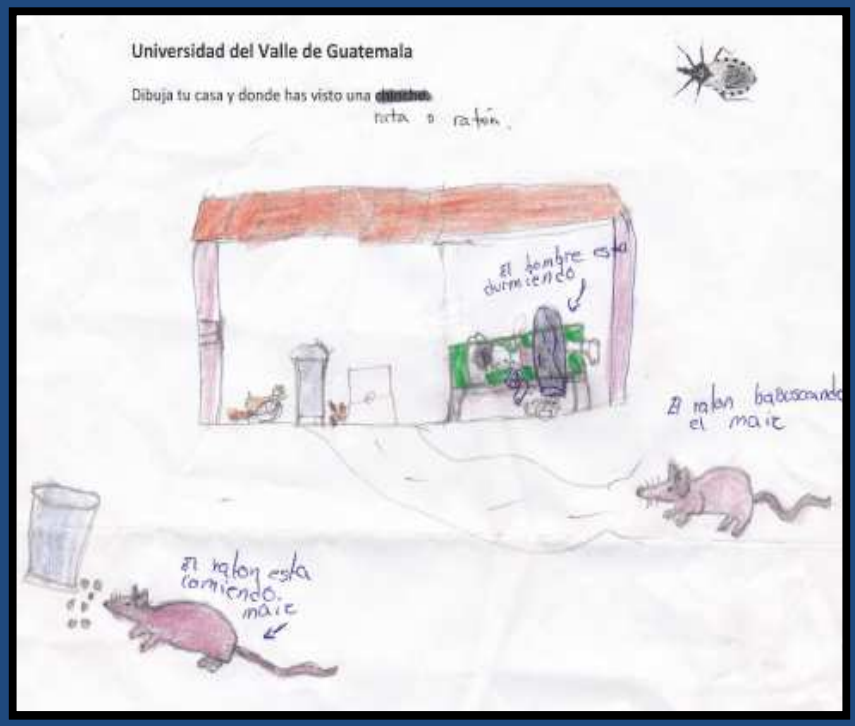
Phase 5: Situational analysis
Stakeholder map and policy analysis

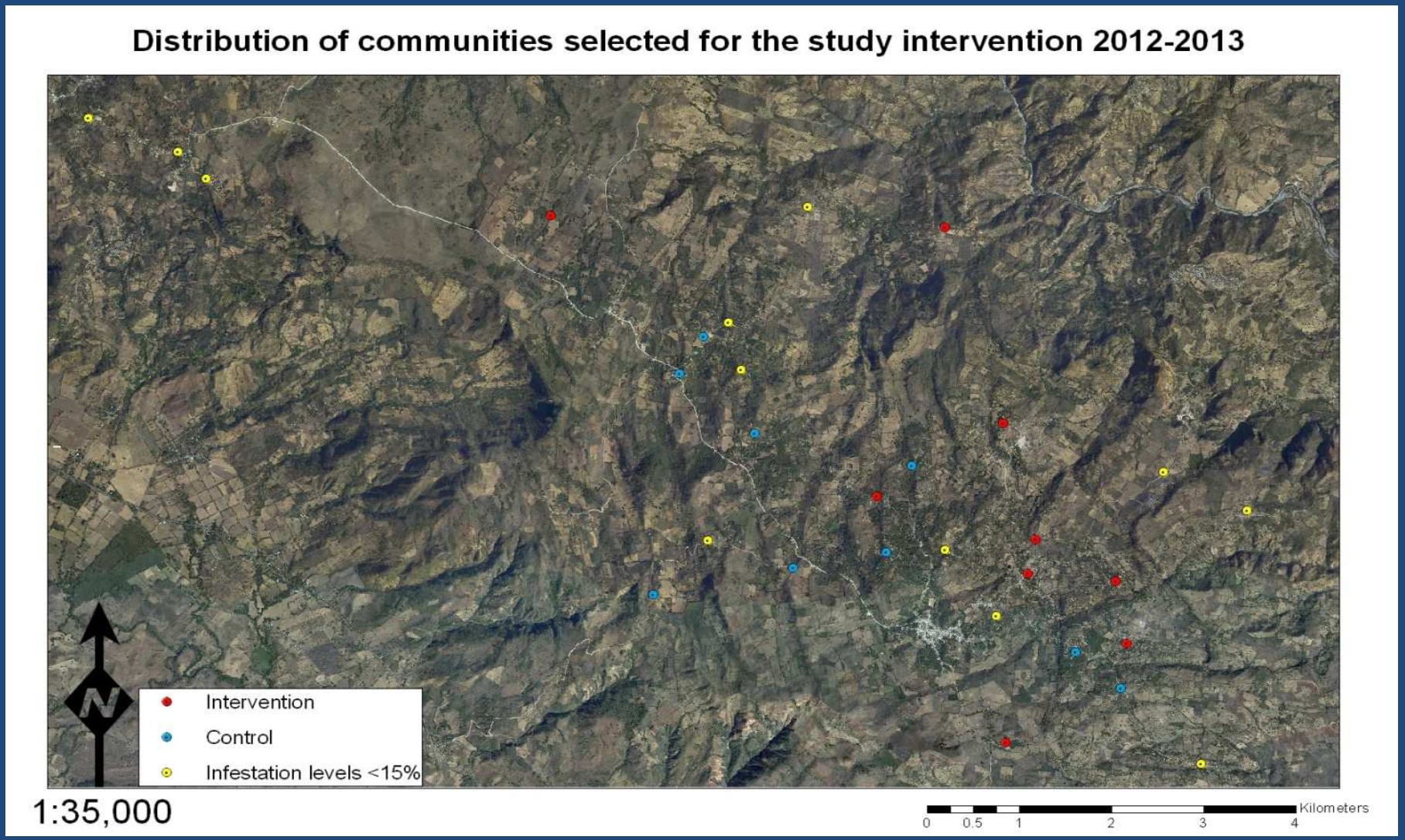


Our hypothesis:

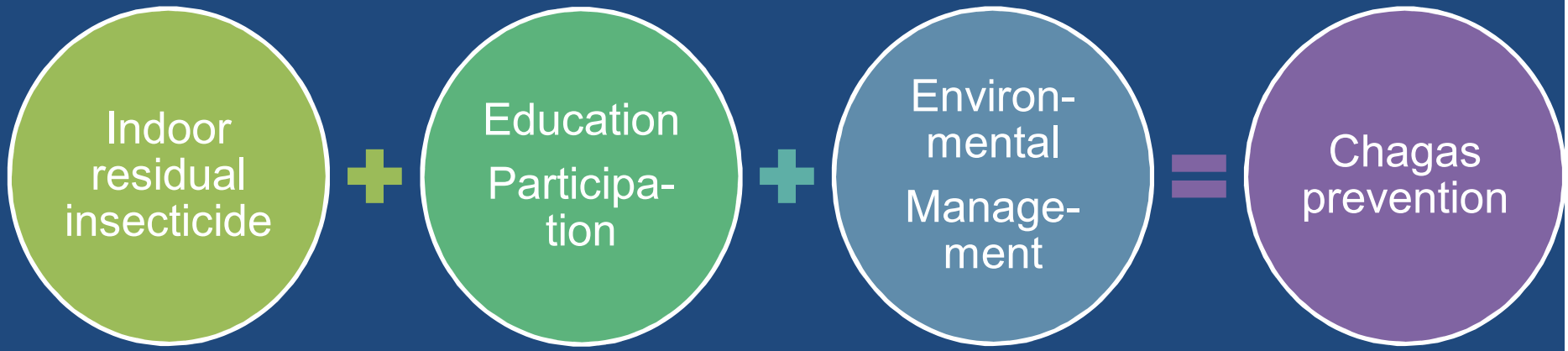
- Rodent nests maintain a constant source of infestation and transmission in the house
- If rodent nests are reduced, transmission should also be reduced

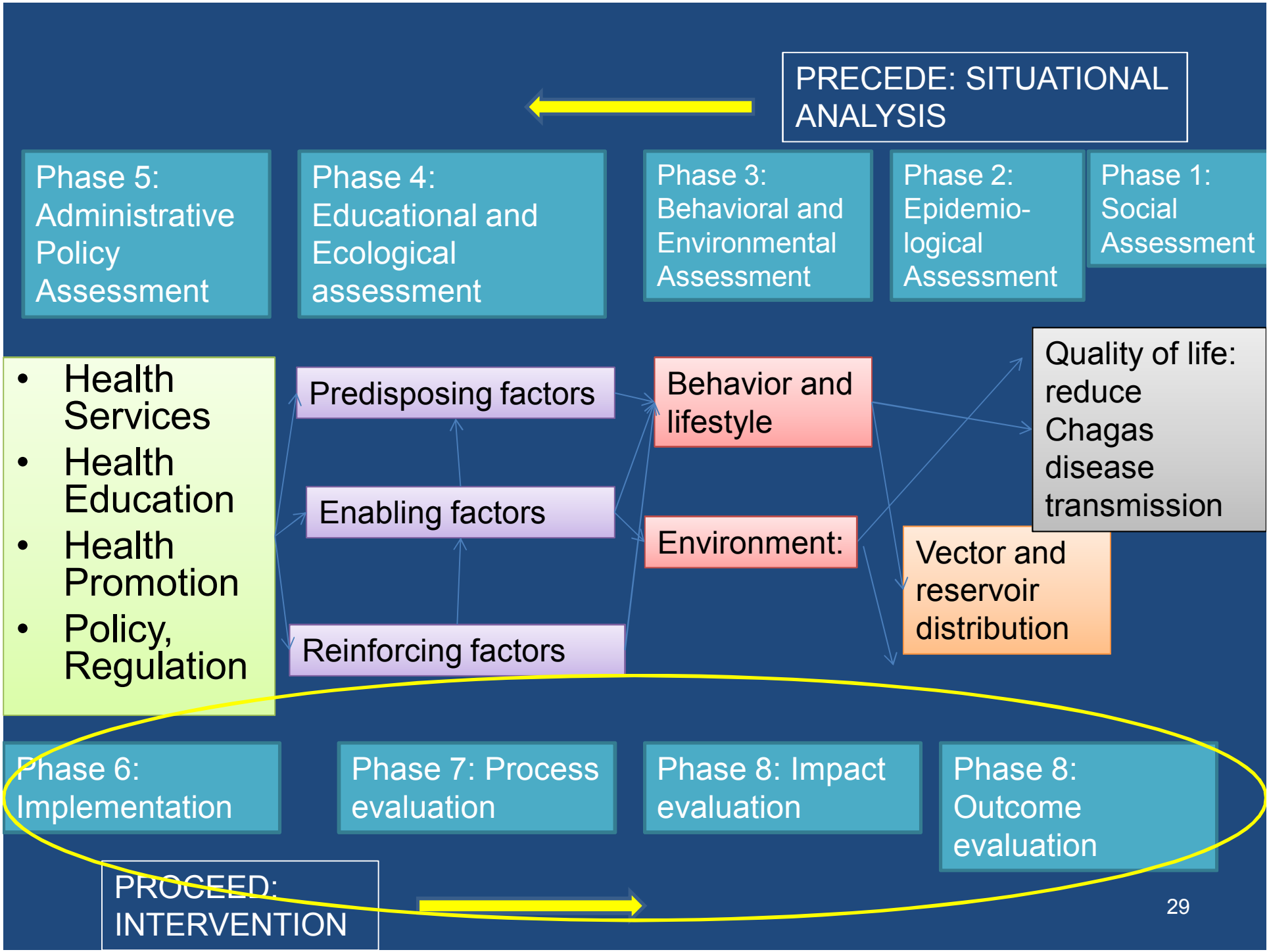


We chose a cluster randomized cohort study design



Our Intervention: Healthy environments for Chagas disease control

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PROCEED: INTERVENTION

We chose a community-based participatory strategy

- 9 Participatory activities
- Education, reflection and discussion of risk factors and the disease
- SWOT analysis

De Urioste-Stone and Pennington et al 2015 Trans Roy Soc Trop Med Hyg

We chose a community-based participatory strategy

- Combined bottom-to-top and top-to-bottom strategies
- Vector personnel supervised community volunteers to spray insecticide

De Urioste-Stone and Pennington et al 2015 Trans Roy Soc Trop Med Hyg

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

De Urioste-Stone and Pennington et al 2015 Trans Roy Soc Trop Med Hyg

We chose a community-based participatory strategy

Intersectoral environmental management to reduce rodent infestations

De Urioste-Stone and Pennington et al 2015 Trans Roy Soc Trop Med Hyg

We chose a community-based participatory strategy

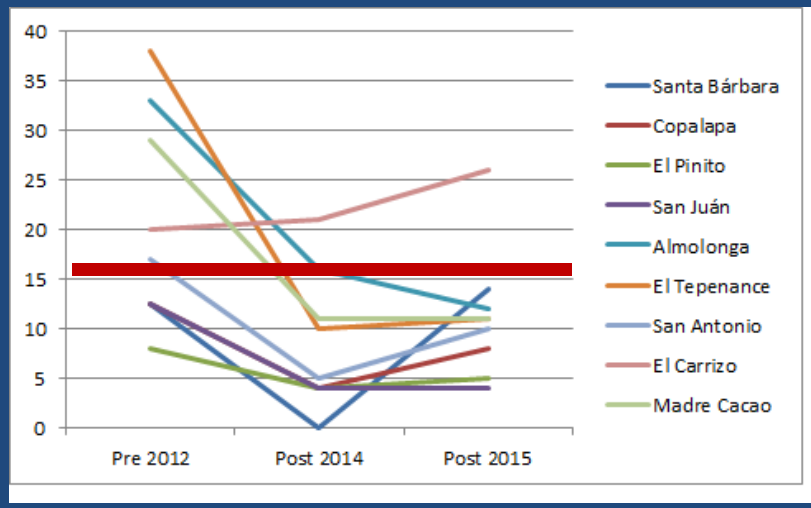
De Urioste-Stone and Pennington et al 2015 Trans Roy Soc Trop Med Hyg

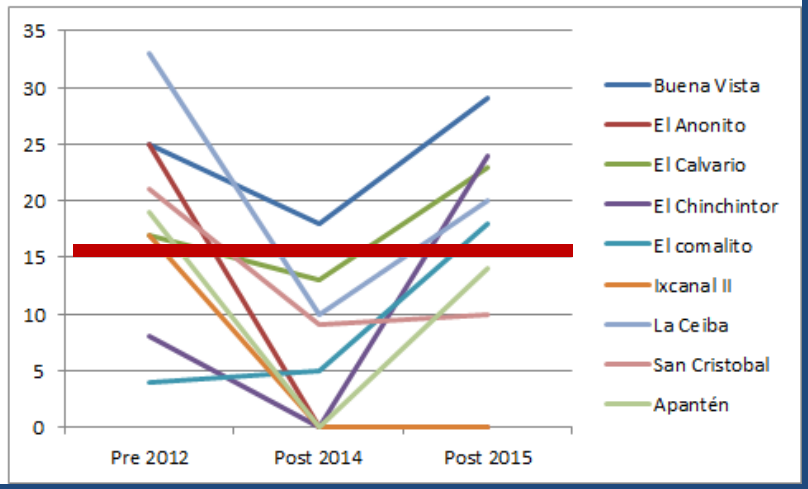
Our intervention achieved sustainable vector control levels

Intervention

Control

Infestation (%)

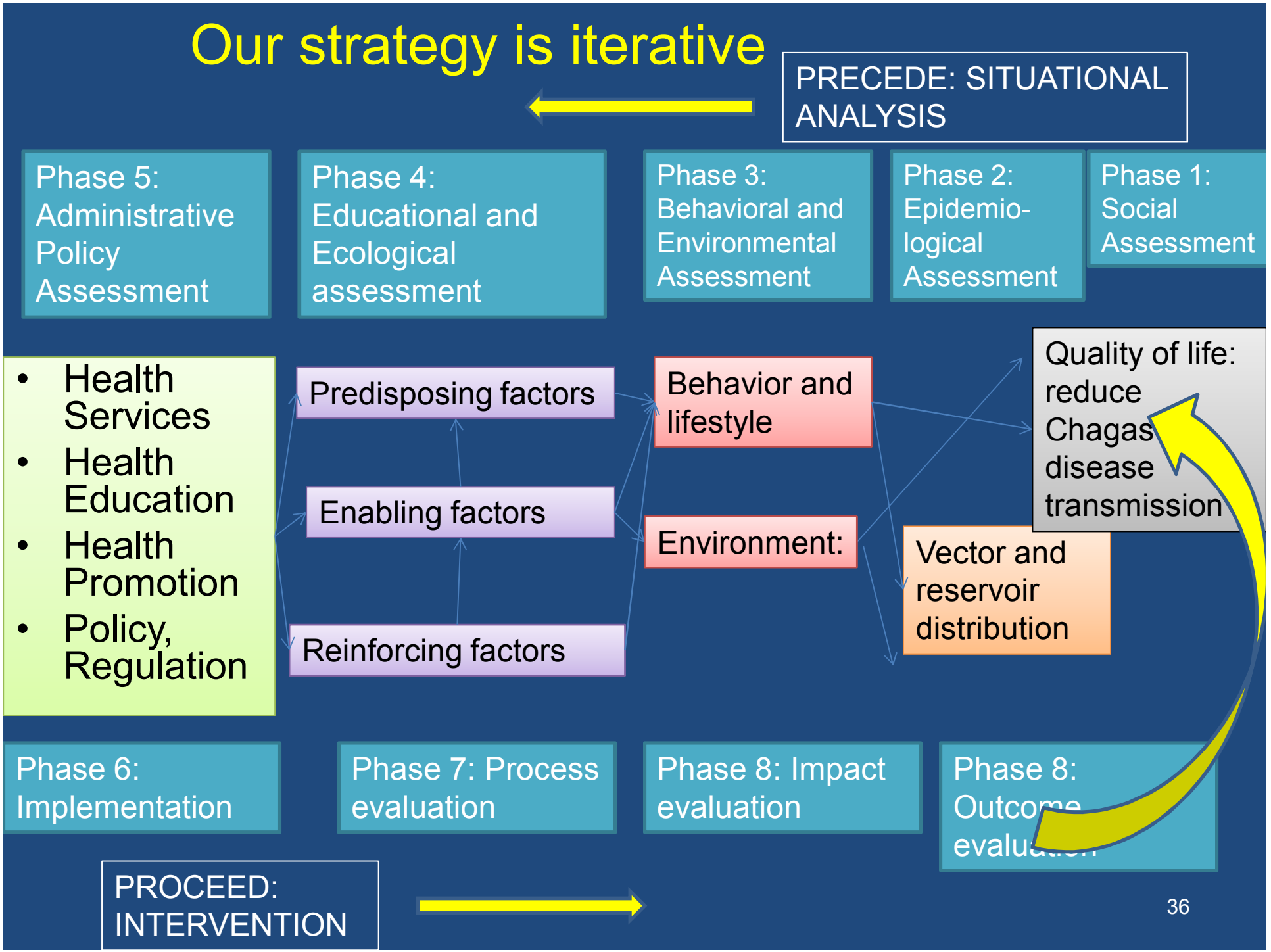




Significant difference,
GLMM $p<0.05$

" 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



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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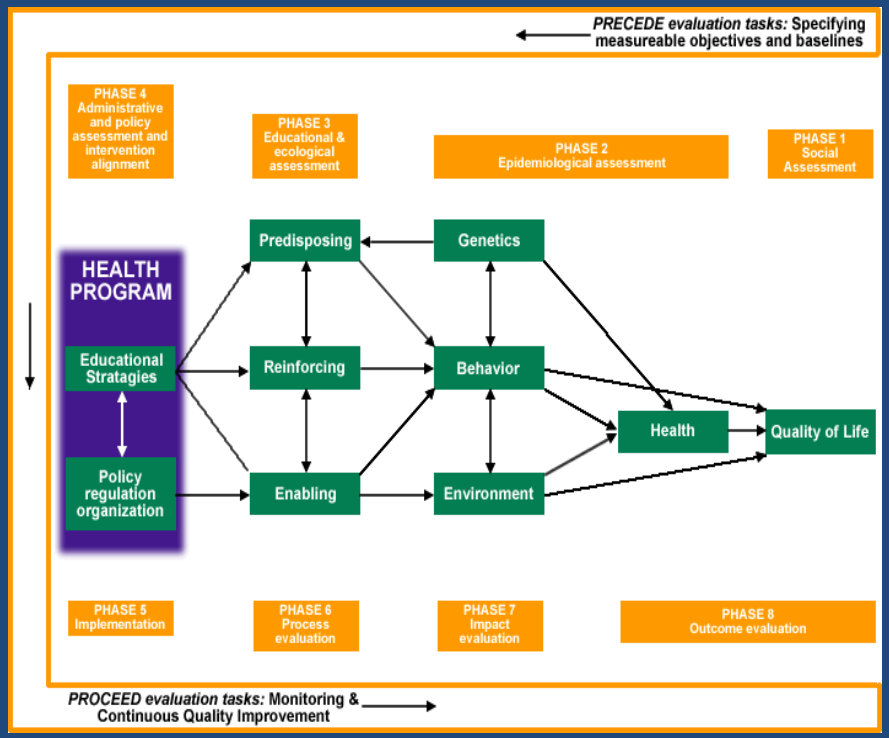
Complex socioeconomic problems need multidisciplinary approaches

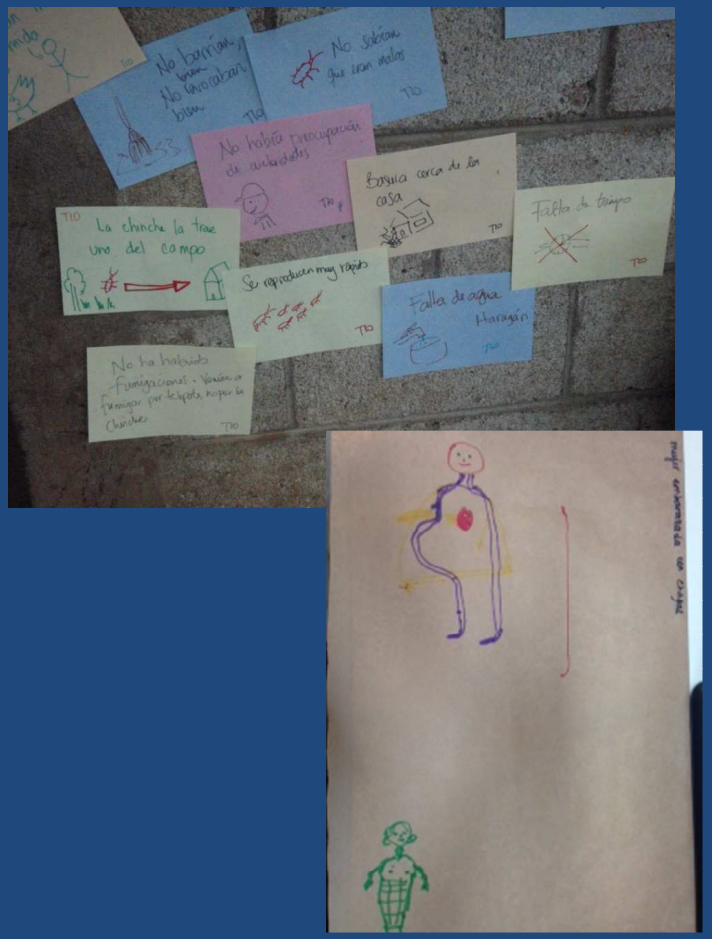
- Use an iterative process
- Combine bottom-up and top-to-bottom strategies
- There is no single magic bullet
- Use all the tools in the toolbox!



(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

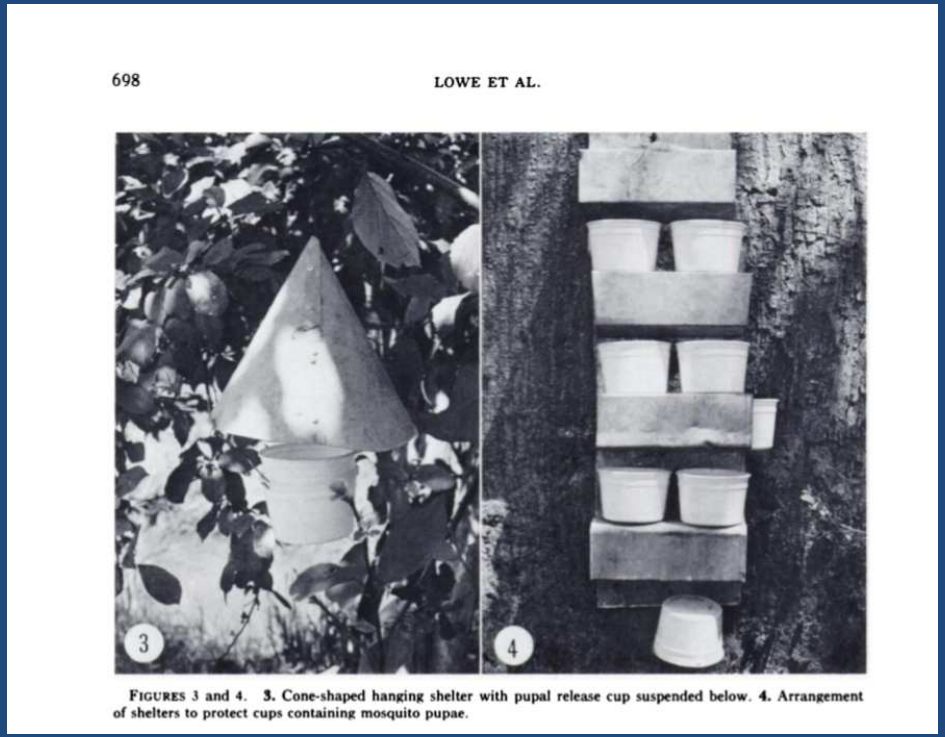
- Map stakeholders
- But, be aware that the recruitment process will affect the end product
- Ex. house-to-house processes will produce gender bias
- Involve leaders as participants, not only supporters!

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



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3 4

FIGURES 3 and 4. 3. Cone-shaped hanging shelter with pupal release cup suspended below. 4. Arrangement of shelters to protect cups containing mosquito pupae.

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

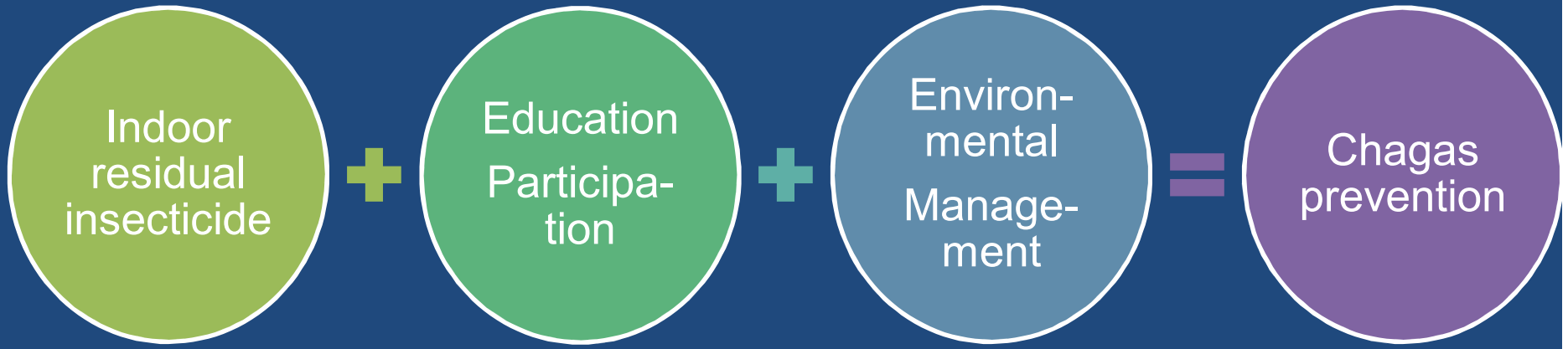
- COCODES and communities of Comapa and Zapotitlán

World Health Organization TDR For research on diseases of poverty UNICEF • UNDP • World Bank • WHO

IDRC CRDI

CDC SAFER • HEALTHIER • PEOPLE™

Thank you



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