



WORLD HEALTH ORGANIZATION
 ORGANISATION MONDIALE DE LA SANTÉ

UNDP/WORLD BANK/WHO SPECIAL PROGRAMME FOR
 RESEARCH AND TRAINING IN TROPICAL DISEASES

20223
 Trypanosomiasis, S.A. - P+C
 Trans
 Insect control
 TDR/CHA/PAN/87.3
 ENGLISH ONLY



Panama City, Panama, 28 September - 2 October 1987

REPORT OF A MEETING ON RESEARCH NEEDS IN THE FIELD OF
 CHAGAS' DISEASE VECTOR CONTROL

CONTENTS

	<u>Page</u>
1. BACKGROUND	2
2. INTRODUCTION	2
3. ENVIRONMENTAL MANAGEMENT, HOUSING IMPROVEMENT AND CHEMICAL CONTROL	2
3.1 General Considerations	2
3.2 Environmental Management	3
3.3 Housing Improvement	3
3.4 Chemical Control	4
4. BIOLOGY AND ECOLOGY OF VECTORS	4
4.1 Epidemiological Aspects	4
4.2 Parasite Development within the Vector	5
4.3 Ecological Aspects of Vector Population Dynamics	5
5. MONITORING AND EVALUATION OF CONTROL ACTIVITIES	5
5.1 Vector Detection	6
5.2 Treatment of Dwellings	6
5.3 Identification of New Cases	6
5.4 Research Priorities	6
REFERENCES	7
ANNEX I: Participants	8
ANNEX II: Agenda	10
ANNEX III: General Recommendations on Laboratory and Field Trials of New Chemical Control Agents	12

This report contains the collective views of an international group of experts convened by the UNDP/WORLD BANK/WHO SPECIAL PROGRAMME FOR RESEARCH AND TRAINING IN TROPICAL DISEASES (TDR). It does not necessarily reflect the views of TDR/WHO. In the interests of rapid communication it has been submitted to only minimal editorial revision. Moreover, any geographical designations used in the report do not imply the expression of any opinion whatsoever on the part of TDR or WHO concerning the legal status of any country, territory, city or area or of its authorities concerning the delimitation of its frontiers or boundaries.

Ce rapport exprime les vues collectives d'un groupe international d'experts réuni par le PROGRAMME SPECIAL PNUD/BANQUE MONDIALE/OMS DE RECHERCHE ET DE FORMATION CONCERNANT LES MALADIES TROPICALES (TDR). Il ne représente pas nécessairement les vues du TDR/OMS et, en vue d'une diffusion accélérée, il n'a pas été l'objet d'une mise en forme particulièrement soignée. En outre, les noms géographiques utilisés dans le présent rapport n'impliquent, de la part du TDR ou de l'OMS, aucune prise de position quant au statut juridique de tel ou tel pays, territoire, ville ou zone, ou de ses autorités, ni quant au tracé de ses frontières.

1. BACKGROUND

A meeting on research needs in the field of Chagas' disease vector control was held at the University of Panama, Panama City, from 28 September to 2 October 1987, in compliance with a recommendation of the Steering Committee on the Epidemiology and Vector Biology and Control of Chagas' Disease, UNDP/WORLD BANK/WHO Special Programme for Research and Training in Tropical Diseases (TDR).

Dr O.E. Sousa was elected Chairman of the meeting, Dr E.N. Zerba, 1st Vice-Chairman, Dr J.C.P. Dias, 2nd Vice-Chairman, and Dr C. Wisnivesky-Colli, Rapporteur. The participants divided into three working groups for detailed technical discussions.

Priority areas for research on Chagas' disease vector control are identified in this report.

2. INTRODUCTION

Future strategies for the control of Chagas' disease should be based on intersectoral activities aimed at the promotion of health as an integral part of the social and economic development of affected communities. It is therefore advisable to explore and evaluate the effect of several control measures, including housing improvement, the use of appropriate insecticides and insecticidal formulations in different epidemiological situations, health education, and other health interventions such as environmental sanitation and general rural and agricultural development. This approach extends the scope of research beyond the assessment of isolated technological interventions for housing and environmental improvement to the implementation of alternative and integrated control activities against Chagas' disease vectors and, whenever possible, against other coexisting vectors and rodents.

The meeting welcomed the development and field testing of new tools for Chagas' disease vector control through TDR financial support as a prime example of a useful, and enriching interaction between academic and other research groups and national control programmes.

Within this context the meeting considered that existing methods for Chagas' disease vector control were appropriate for maintaining current control programmes and for implementing new ones in other endemic countries. However, it was considered that the highest priority should be given to operational research and cost-effectiveness studies aimed at improving present or future technologies in different economic situations. Research should include entomological, serological and parasitological assessment of the impact of control technologies.

3. ENVIRONMENTAL MANAGEMENT, HOUSING IMPROVEMENT AND CHEMICAL CONTROL

3.1 General Considerations

Control programme authorities must consider economic factors in the selection of control measures. However, there is no satisfactory methodology to determine the cost-effectiveness of different control activities applied in different epidemiological situations. Research addressing this issue and studies aimed at reinforcing community participation in control activities are considered a priority.

In this connection the following research areas were considered to be of priority: (1) development of methods for the analysis of the cost-effectiveness of vector control programme components; (2) community participation in control programmes; and (3) epidemiological characterization of endemic areas with a view to developing the most appropriate and cost-effective control strategies.

3.2 Environmental Management

The use of integrated methods of vector control that emphasize environmental management is also valid in Chagas' disease vector control.

Although in the case of other vectorborne diseases, such as malaria and filariasis, the main reason to emphasize environmental management in vector control is increasing insecticide resistance, in the case of Chagas' disease this approach is mainly based on economic and environmental considerations.

Housing improvement can be considered as a form of environmental management by which the ecotopes that are suitable for intradomestic triatomine species are eliminated. The meeting also discussed the potential importance of peridomestic structures in maintaining transmission of Chagas' infection. In this respect the following research needs were identified: (1) studies on the ecology of peridomestic vector species, particularly on spatial and temporal species succession as a consequence of control activities; and (2) studies on the importance of peridomestic vector species in the epidemiology of Chagas' disease transmission in domestic environments.

Research in the following areas was recommended:

- Assessment of the importance of the peridomestic area in disease transmission in zones where control of intradomestic vectors has been achieved.
- Development of effective methods and appropriate tools for peridomestic environmental management to control T. cruzi vectors and reservoirs.
- Evaluation of the effectiveness of these newly developed vector control methods as both isolated and integrated measures.

3.3 Housing Improvement

In rural areas of Latin America most human dwellings are constructed with substandard materials (wattle and mud, palm roofs) which make them an excellent habitat for triatomines. Housing improvement has been recognized as an ideal and permanent measure which in the long term will eliminate T. cruzi transmission to humans. However, even though some attention has been paid to this approach, because of the anticipated high costs involved in any housing programme, the lack of appropriate techniques for housing improvement in rural areas and the lack of adequate methods to stimulate active community participation in health promotion, it has not been sufficiently emphasized as an integral part of the social and economic development of affected communities.

Research in the field of housing improvement should lead to advances in construction techniques using appropriate materials for the control of Chagas' disease vectors and other insects and rodents. In the treatment of the peridomestic environment, special attention should be given to the use of materials, including those produced in local handicrafts, that make peridomestic structures less receptive to vector colonization. Health education to modify negative cultural patterns should also be carried out.

3.4 Chemical Control

Among currently available insecticides there are some products, such as pyrethroids, with proven effectiveness against Chagas' disease vectors that are being used successfully in large-scale control programmes. Pursuit of the following research lines is recommended:

3.4.1 Evaluation of new insecticides

- Assessment of the triatotoxic effect of commercially available insecticides that have not yet been tested against the main vector species.
- Assessment of the efficacy of insecticides against peridomestic vector species.

3.4.2 Methods of chemical control

- Development of more appropriate formulations of active principles using new vehicles or synergists.
- Development of optimal methods of insecticide application according to type of dwelling, vector behaviour, formulations and available spraying equipment.

3.4.3 Other aspects of chemical control

- Studies of products, formulations and means for their application in domestic and peridomestic environments that are known to be involved in the transmission process.
- Studies on the identification and application of chemical compounds that demonstrate the potential to lead to advances in control.
- Studies on vector resistance and on techniques for monitoring resistance.
- Toxicological studies of acute and chronic effects in both humans and animals.

4. BIOLOGY AND ECOLOGY OF VECTORS

The group agreed on the need to maintain and support reference centres for parasite, vector and blood-meal characterization. Information exchange and the monitoring of different triatomine species in areas along national borders, with a view to measuring movements between countries, are also necessary. The following priority research areas were identified:

4.1 Epidemiological Aspects

- Integrated studies of vector population dynamics and parasite transmission in relation to the physical and environmental conditions of these populations; study of the dynamics of vectorial capacity and minimum vector population levels needed for transmission.
- Development of predictive models of parasite transmission risk and comparison of these with experimental data, with a view to improving control strategies.

- Study of the effect of growth and reproduction regulators on vector population dynamics.
- Study of non-vectorial disease transmission routes and assessment of their epidemiological importance in relation to transmission by vectors.
- Characterization of T. cruzi subpopulations in endemic areas.

4.2 Parasite Development within the Vector

- Quantitative and qualitative studies on parasite biochemistry and on the biochemistry of the internal milieu and its relationship to the type of vector meal.
- Effect of neurotoxic insecticides and of growth and reproduction regulators on vector susceptibility to infection. Effects of these compounds on moulting and maturation processes of the vector reproductive system.

4.3 Ecological Aspects of Vector Population Dynamics

- Determination of interspecific and intraspecific factors of vector dispersion and aggregation in different geographical areas.
- Study of flight dispersion patterns.
- Research on colonization of different ecotopes by different species, with particular emphasis on intradomestic ecotopes.
- Identification of natural barriers preventing geographical extension of certain species.
- Use of experimental nests for ecological and population control studies.
- Research on pheromones affecting vector behaviour and their use with different types of traps.
- Identification of natural reserves of different triatomine species.
- Research on biochemical characterization of different species and subspecies.
- Research on domestic and peridomestic microcycles of T. cruzi.
- Development of seroepidemiological techniques to identify sources of vector blood-meals (domestic, synantropic, sylvan).
- Development of natural products with repellent or insecticidal action against T. cruzi vectors.

5. MONITORING AND EVALUATION OF CONTROL ACTIVITIES

The transmission of T. cruzi infection to humans by triatomine vectors accounts for the majority of cases registered in Latin American countries. Other disease transmission routes, such as perinatal transmission and particularly transmission via blood transfusion, are also becoming important, especially in urban areas. The group limited its discussions to research needs in the evaluation and monitoring of activities directed at vector control.

Entomological and epidemiological surveillance activities carried out as part of primary health care and with community participation were considered essential throughout the different phases of control programme operations. Criteria should be developed to guide in the transition from the control phase to epidemiological surveillance. Sometimes surveillance can be established as soon as the house-spraying phase is completed.

All these activities should be coordinated from the beginning with other components of the health sector and with other relevant agencies within a framework of active community participation. Epidemiological surveillance should be part of a continuous, interlinked and progressive process, which should prove successful if it enlists the participation of the community. To implement such surveillance activities it is necessary to provide the primary health worker (or equivalent community health worker) with appropriate technology to carry out specific tasks, such as vector detection, foci identification, treatment of infested houses and identification of new cases.

5.1 Vector Detection

The introduction of systems for the longitudinal detection of triatomine populations in residual foci or reinfestations using the available methods^{1,2,3,4,5,6} is recommended. Detection systems should be integrated with health education programmes designed to stimulate the awareness of the community.

5.2 Treatment of Dwellings

Treatment should be carried out, preferably by primary health care workers (or equivalent community health workers), as soon as a dwelling is found to be reinfested in order to minimize transmission risk. The response system should be quick, simple and coherent in order to reinforce community involvement. Appropriate technology for these treatments should include the use of insecticides that have low environmental impact.

5.3 Identification of New Cases

In view of the potential risk of vectorial transmission in areas under surveillance, a continuous and efficient screening system for detection of new cases (acute cases and serological conversions) should be implemented. Simple blood collection procedures, such as the micromethod or filter paper techniques^{7,8}, which can be carried out by non-specialist personnel should be used. For serological diagnosis any of the recommended techniques should be used⁹. New cases detected through the above procedures should be sent to the regular health services for diagnostic confirmation and treatment.

To assess the impact of measures carried out in an endemic area under control, entomological and epidemiological indicators should be used. The most sensitive indicator to monitor control is the prevalence rate of seropositives in children less than five years of age.

The control activities should be implemented through primary health care or similar programmes that use community health workers. These control measures should be integrated, with adequate supervision from the health services, in such a way as to allow both a gradual transfer of activities to the community and continuity in the provision of control materials.

5.4 Research Priorities

Research on methods for the monitoring and evaluation of control should be conducted in the following areas:

5.4.1 Insecticidal compounds, formulations and application techniques

- Development of cheap and effective parasitological and serological diagnostic techniques.
- Development of new techniques for the detection of domiciliary, and particularly peridomestic, triatomines that take into account different behavioural patterns of different species.
- Studies on innovative approaches to health education and community participation.

5.4.2 Development and/or improvement of operational systems, particularly with regard to:

- Primary health care systems.
- Integration of multidisciplinary teams incorporating investigators, administrators and staff of health programmes.

5.4.3 Communications campaigns for health education

5.4.4 Development and improvement of statistical techniques for evaluation of control activities.

5.4.5 Standardization of serological and entomological indicators in different epidemiological situations.

5.4.6 Development of suitable methods for the transfer of results of pilot research projects to primary health care programmes.

REFERENCES

1. GOMEZ-NUNEZ, J.C., Acta Cientifica Venezolana, 16: 26-31 (1965).
2. WISNIVESKY-COLLI, C., PAULONE, I., PEREZ, A.L. ET AL. Medicina (Buenos Aires), 47: 45-50 (1987).
3. MARSDEN, P. & PENNA, R.A., Transactions of the Royal Society of Tropical Medicine and Hygiene, 76: 790-792 (1982).
4. GARCIA-ZAPATA, M.T., MARSDEN, P. & VIRGUES, D. Revista de la Sociedad Brasileira de Medicina Tropical, 19 (Suppl. II): 66 (1986).
5. PINCHIN, R., FANARA, D.M., CASTLETON, C.W. & OLIVEIRA-FILHO, A.M., Transactions of the Royal Society of Tropical Medicine and Hygiene, 75: 691-694 (1981).
6. PINCHIN, R., FANARA, D.M., CASTLETON, C.W. & OLIVEIRA-FILHO, A.M. Insect Sci. Application, 3: 1, 79-84 (1982).
7. SUBIAS, E., YANOVSKY, J., ALVAREZ, M. & SEGURA, E.L. Protozool., 164, (1983).
8. HOFF, R., RODD, C.W., MAGUIRE, J.H. ET AL. Annales de la Société Belge de Médecine Tropicale, 65 (Suppl. 1): 187-196 (1985).
9. TDR. Report of the meeting on longitudinal epidemiological studies on Chagas' disease. Document TDR/EPICHA-LES/83.3 (1983).

ANNEX I:

PARTICIPANTS

- *ADAMES, Dr A., Rector, Universidad de Panama, Panama City 5, Panama
- BECKER, Dr D., Head, Chagas' Disease Control Programme, Paseo Colon 568,
2° piso, 1063 Buenos Aires, Argentina
- CHUIT, Dr R., Servicio Nacional de Control de Enfermedad de Chagas, 9 de Julio
356, 5000 Cordoba, Argentina
- DIAS, Dr J.C.P., Chief, Chagas' Programme, SUCAM, Ministerio da Saude,
Esplanada dos Ministerios, Bloco II - 7° andar, Brasilia, Brazil
(VICE-CHAIRMAN)
- GARCIA-ZAPATA, Dr M.T., Nucleo de Medicina Tropical e Nutricao, Caixa Postal
15-3121, CEP 70919, Brasilia DF, Brazil
- GILBERT, Dr B., Research Director, CODETEC, Estrada Telebras-UNICAMP Km 1,
Caixa Postal 6041, Cidade Universitaria, Campinas 13081 SP, Brazil
- GORLA, Dr D.E., Facultad de Ciencias Exactas Fisicas y Naturales, Universidad
Nacional de Cordoba, Velez Sarsfield 299, 2000 Cordoba, Argentina
- OLIVEIRA-FILHO, Dr A., Nucleo de Pesquisas de Produtos Naturais, Centro de
Ciencias da Saude, Bloco H, Universidade Federal do Rio de Janeiro,
21941 Rio de Janeiro, Brazil
- OTERO, Dr M.A., Head, Division of Rural Endemic Diseases, Division of
Malariaology, Ministry of Health, Maracay, Venezuela
- *PINEDA, Dr C. Division of Vector Control, Ministerio de Salud, Tegucigalpa
DC, Honduras
- SOUSA, Dr O.E., Vice-Rector for Research, Universidad de Panama, Facultad de
Medicina, Panama City 5, Panama (CHAIRMAN)
- STOKA, Dr A.M., INDIECH, "Dr Mario Fatala Chaben", Paseo Colon 568 - 7° piso,
1063 Buenos Aires, Argentina
- WISNIVESKY-COLLI, Dr C., INDIECH, "Dr Mario Fatala Chaben", Paseo Colon 568 -
7° piso, 1063 Buenos Aires, Argentina (RAPORTEUR)
- ZERBA, Dr E.N., Instituto de Investigaciones Cientificas y Tecnicas de las
Fuerzas Armadas, Zufriategui y Varela 1406, 1603 Villa Martelli, Pcia.
de Buenos Aires, Buenos Aires, Argentina (VICE-CHAIRMAN)

* Unable to attend.

WHO Secretariat

ARIAS, Dr J., Pan American Health Organization, Panama

BOS, Dr R., Division of Vector Biology and Control, Geneva

CEDILLOS, Dr R., Pan American Health Organization, Washington DC, USA

MONCAYO, Dr A., Special Programme for Research and Training in Tropical Diseases, Geneva

NELSON, Dr M., Pan American Health Organization, Panama

TONN, Dr R.J., Las Cruces, New Mexico, USA (Temporary Adviser)

ANNEX II:

MEETING ON RESEARCH NEEDS IN THE FIELD OF
CHAGAS' DISEASE VECTOR CONTROL:

AGENDA

1. Opening of the meeting
2. Election of officers, adoption of the agenda and tentative programme of work
3. Introductory statement on the objectives of the meeting Dr A. Moncayo
4. Present status of knowledge of vectors of Chagas' disease in Central and South America: Ecology, biology, physiology, bionomics, toxicology and resistance to insecticides Dr R.J. Tonn
5. Progress in TDR-sponsored research on vectors of Chagas' disease: A review and analysis of biological, epidemiological and control aspects Dr A.M. Oliveira-Filho
6. Research needs and their relationship to effective control of the vector
 - a) Chemical control
 - Development of new insecticides and synergists: Laboratory and field trials Dr E.N. Zerba
 - Mode of action of conventional insecticides and mechanisms of resistance Dr E.N. Zerba
 - Development of formulations and determination of dosages and application schedules to fit specific situations Dr A.M. Oliveira-Filho
 - Transfer of technology from research to practical control Dr B. Gilbert
 - b) Improved housing and other environmental management for Chagas' disease vector control
 - The effectiveness of design and construction materials in Chagas' disease vector control Dr R. Cedillos
 - The importance of peridomestic environmental management for Chagas' disease vector control Dr K. Bos

- c) Biology and ecology of vectors
- The relationship between vector species and their vectorial capacity for certain strains of T. cruzi Dr O.E. Sousa
 - Climatological considerations in the design of control strategies Dr D.E. Gorla
 - Rural resource development and its potential to introduce domestic vectors into new epidemiological situations Dr J.C.P. Dias
 - Disruption of development in triatomines by juvenile hormones Dr A.M. Stoka
- d) Monitoring and evaluation
- Development of improved methodologies and indicators for the monitoring and evaluation of vector control operations Dr M. Nelson
 - Use of a new vector control tool in surveillance programmes within a primary health care approach Dr C. Wisnivesky-Colli
 - Initial results of a new control method in Santiago del Estero, Argentina: Relationships with the government vector control programme and economic and operational aspects Dr R. Chuit
 - Vector surveillance using household and community resources Dr M.T. Garcia-zapata
8. Research needs as perceived from the point of view of vector control management
- Participants:
Dr D. Becker
(Coordinator)
Dr J.C.P. Dias
Dr M.A. Otero
Dr R. Chuit
9. Conclusions and recommendations
10. Closure of the meeting

ANNEX III:

GENERAL RECOMMENDATIONS ON LABORATORY AND FIELD
TRIALS OF NEW CHEMICAL CONTROL AGENTS

1. New chemical control agents should be tested in the laboratory before they are evaluated in the field for insecticidal and residual effects. Trials of new formulations should take into consideration the substrates on which the agent is to be applied in the field.
2. In tests of insecticidal activity, residual effects and insecticide resistance, biological material (developmental stage), human population characteristics and test conditions (temperature, light, humidity) should be carefully standardized.
3. Field application doses should be prepared by measuring actual weights, volumes and application surface areas as accurately as possible for each unit sprayed.
4. Different groups of treated houses should be as homogeneous as possible with regard to: (a) type of dwelling (walls, roof, domicile or peridomicile); (b) vector species involved; and (c) degree of infestation.
5. Special attention should be given to: (a) safety requirements for operators, dwellers and domestic animals*; (b) physico-chemical characteristics of formulations; and (c) acceptability of formulations to the community and to the operators.
6. All ethical considerations should be respected; in particular, the use of house control groups without treatment should be avoided. Houses in control groups should be treated with a product of known efficacy under the same or similar conditions.

* WHO Technical Report Series, No. 720 (Safe use of insecticides: Ninth report of the WHO Expert Committee on Vector Biology and Control), 1985.