

# Rural campaign to diagnose and treat mucocutaneous leishmaniasis in Bolivia

J.-P. Dedet,<sup>1</sup> R. Melogno,<sup>2</sup> F. Cardenas,<sup>3</sup> L. Valda,<sup>4</sup> C. David,<sup>5</sup> V. Fernandez,<sup>6</sup> M.E. Torrez,<sup>5</sup> L. Dimier-David,<sup>5</sup> P. Lyevre,<sup>5</sup> & M.E. Villareal<sup>7</sup>

*Mucocutaneous leishmaniasis (MCL) is endemic in the tropical Amazonian lowlands of Bolivia, an area that regularly receives influxes of migratory populations. In these new agricultural development areas, a campaign to diagnose and treat the disease was carried out between 1989 and 1992, in order to provide direct access to MCL treatment in the endemic areas at a standard equivalent to that offered in the urban centres in Bolivia.*

*The campaign led to the creation of decentralized local centres for diagnosis and treatment of the disease. A campaign to inform the population about leishmaniasis was also undertaken and courses were run to educate medical and paramedical personnel. As a result of the campaign, 3285 cases of leishmaniasis were diagnosed, including 2152 cutaneous and 326 mucosal forms. Also, a total of 1888 cases were treated, 1677 of which were cutaneous and 211, mucosal.*

## Introduction

Mucocutaneous leishmaniasis (MCL) caused by *Leishmania braziliensis* Vianna, 1911 (1) occurs in two stages: a primary cutaneous lesion, followed (in some cases) by a secondary mucosal involvement, often resulting in severe facial deformities (2). MCL is endemic in numerous countries of South and Central America (3, 4) and is the predominant form of leishmaniasis in Bolivia, where it extends to the majority of the tropical Amazonian lowlands, including the Yungas and the Cordillera Oriente region (5, 6). These regions are colonization zones where high-altitude populations regularly migrate, ejected from the Andean highlands by the low productivity

of the land, the ending of mining activities following the fall in metal prices, and a government policy of relocation. The arrival of new populations in these agricultural development areas produces a rich and varied pattern of tropical diseases, in which MCL predominates.

Methods for controlling leishmaniasis are generally limited and depend on the epidemiological type of the disease and the natural life-cycle of the corresponding parasite species (7–9). In this respect, MCL is one of the most unfavourable types, since it is a wild zoonosis of sylvatic regions whose natural reservoirs remain unknown; moreover, it occurs in medically underequipped areas inhabited by poor populations.

The present article reports one intervention strategy against MCL: the Diagnosis and Treatment of MCL, Rural Campaign (DTLRC), which has been carried out in Bolivia in the Yungas, Alto Beni, and Beni regions since August 1989.

## Materials and methods

### *The problem and adopted strategy*

MCL is endemic in Bolivia, where a retrospective study recently reported that a total of 4058 cases had been reported between 1975 and 1991, of which 739 had mucosal involvement (5). The isolates obtained from cutaneous as well as mucosal lesions have consistently been characterized as *L. braziliensis* (10, 11). With a 1–3% prevalence of MCL, Yungas and Alto Beni are the regions that have the highest endemicity (5).

<sup>1</sup> Co-Director, Instituto Boliviano de Biología de Altura, La Paz, Bolivia. Present address: Laboratoire d'Ecologie Médicale et Pathologie Parasitaire, Faculté de Médecine de Montpellier, Université de Montpellier 1, 163, rue Auguste-Broussonet, 34000 Montpellier, France. Requests for reprints should be sent to Professor Dedet at this address.

<sup>2</sup> Director, Programa de Asentamientos Humanos, La Paz, Bolivia.

<sup>3</sup> Chief, Dermatology Department, Hospital de Clinicas, Universidad Mayor de San Andrés, La Paz, Bolivia.

<sup>4</sup> Professor, Dermatology Department, Hospital de Clinicas, Universidad Mayor de San Andrés, La Paz, Bolivia.

<sup>5</sup> Scientist, Instituto Boliviano de Biología de Altura, La Paz, Bolivia.

<sup>6</sup> Executive Director, Programa de Asentamientos Humanos, La Paz, Bolivia.

<sup>7</sup> Physician, Dermatology Department, Hospital de Clinicas, Universidad Mayor de San Andrés, La Paz, Bolivia.

Despite this epidemiological situation, the people affected remain untreated for the following reasons: lack of recognition of the severity of the mucosal involvement; their low economic status; lack of health facilities in the endemic areas; and the high cost of therapy. The mucosal lesions, in particular, need prolonged treatment using pentavalent antimony compounds or amphotericin B, under constant medical care.

The low economic status of those infected with MCL and the lack of information combine to prevent them from travelling to La Paz and Santa Cruz, the only places in Bolivia where, before DTLRC began, the necessary treatment was available. Thus affected individuals have tended to remain in the endemic zones, allowing their mucosal lesions to progress until they had destroyed a large part of the face, a common sight in Bolivia (12).<sup>a</sup>

The basic objective of DTLRC was to provide direct access to proper treatment for the affected population inside the endemic areas. Local centres for the diagnosis and treatment of MCL were set up. Moreover, a campaign was initiated to inform the population about DTLRC and educate medical and paramedical personnel about the condition; also, active case detection was undertaken.

**Organizations involved**

DTLRC was a private initiative run by nongovernmental organizations (NGOs) in the endemic zones where leishmaniasis has been prevalent for many years.

The promotion and coordination of the campaign was the responsibility of the Bolivian NGO, Programa de Asentamientos Humanos. The following also took part in the campaign: San Borja and Rurrenabaque parishes; the Association for Rural Cooperation in Africa and Latin America (ACRA); Médecins sans Frontières (MSF); and the Health District of Yungas Larecaja (Tropical).

Two public or semipublic organizations collaborated in planning the campaign and in the scientific and technical supervision of its operations: the Instituto Boliviano de Biología de Altura and the Dermatology Department, Hospital of Clinicas, La Paz.

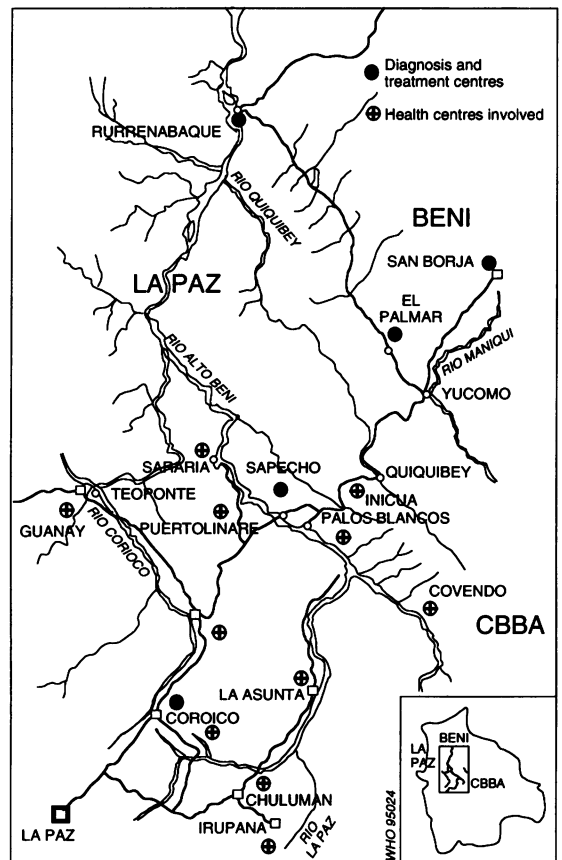
**Territorial extent of the campaign**

Alto Beni (Department of La Paz) and part of the Department of Beni (Rurrenabaque–Yucumo–San Borja regions) were covered by the August 1989 – December 1990 campaign (Fig. 1). Alto Beni is situated at the foot of the Andes (altitude:

400–700 m), while Beni lies in the plain. This zone extends between Sararia and Covendo (west to east) and between Rurrenabaque and Caranavi (north to south) and encompasses approximately 2400 km<sup>2</sup>. It is covered by tropical rain forest. The population consists of colonists who moved there about 25 years ago and is estimated to comprise approximately 10 000 families (50 000 persons) who, after clearing initially forested land, have engaged in agriculture. In this same zone there live also two tribal groups: the Chimanes (ca. 3000 persons) and the Mosestenes (ca. 1200 persons). Although the operational area is crossed by a single, unasphalted road and by various rivers, its uneven topography makes penetration difficult and the majority of settlements have to be visited on foot.

In 1990–92, the DTLRC extended its operations to Yungas (La Paz Department) (Fig. 1). This area consists of high (500–4500 m), narrow, and steep-

Fig. 1. Map showing the area covered by the campaign, 1989–92.



<sup>a</sup> Desjeux P. *Leishmaniose cutanée et cutanéomuqueuse américaine. Etude de 113 cas observés en Bolivie.* Thesis, Paris, 1974.

sided Andean valleys oriented north to south. The vegetation varies with altitude and is tropical up to 1500 m. Yungas has been colonized for more than 300 years and has a population of about 90 000 inhabitants, who live dispersed or grouped in small urban centres. Even though it has a more uneven topography than Beni and Alto Beni, Yungas is more accessible thanks to its better infrastructure.

### **Practical organization of the campaign**

**Sector division.** The Beni and Alto Beni zone was divided into six sectors, centred in one of the following localities: San Borja, Rurrenabaque, Sapecho, Sararia, Covendo, and El Palmar (Fig. 1). Each sector was under the responsibility of one of the executive organizations. A map of the campaign zone (scale, 1:300) was made and a census of the population was carried out. In the Yungas zone, the sector division established by the Ministry of Public Health was adopted, which corresponded to six new sectors.

**Diagnosis and treatment centres.** Three specific centres for diagnosis and treatment of MCL were created in 1989, in Rurrenabaque, San Borja, and Sapecho. Two new centres were subsequently added: the first used the infrastructures of an existing hospital (Coroico) and the second was totally new (El Palmar).

The objectives of these centres were to provide direct diagnosis and adequate treatment for MCL patients in the endemic area. Each centre had a small laboratory equipped with a microscope, centrifuge, spectrophotometer, and water-bath, as well as disposables and basic reagents needed for parasitological diagnosis (smears stained by Giemsa and sometimes biopsies) and for carrying out the tests indicated for the follow-up of the treatment (haemograms, urine analysis, and determination of urea, creatinine, transaminases, alkaline phosphatase, and serum potassium levels).

Each centre was equipped with 8–10 hospital beds to permit treatment of MCL patients with intravenous infusions of amphotericin B under strict medical supervision. Also, each centre guaranteed to distribute drugs (including pentavalent antimony compounds) for the ambulatory treatment of cutaneous leishmaniasis and to follow up patients. They also functioned as the operational centres for case detection and collected epidemiological data on leishmaniasis for their particular area.

**Training of personnel.** Courses and workshops were held regularly, alternately in La Paz and in the endemic zones, to train the medical and paramedical personnel participating in the campaign. Their aim was to update the knowledge of the participants in

all aspects of MCL, particularly its epidemiology, clinical features and evolution, diagnosis, and treatment. A basic objective was also to instruct the participants on organizing meetings to educate the public about the disease.

Over the period August 1989 to December 1990, a total of 10 training courses of 10–15 days' duration were held, each being structured according to the category of the participants (physicians, nurses, or laboratory technicians). After having been trained, the participants organized 37 courses (lasting 1–3 days) to instruct health auxiliaries and those responsible for popular health education, who in turn gave information talks to the public. Over the following 2 years of the campaign, 11 courses were held for health professionals in 1991 and seven in 1992, while 24 and 12 courses, respectively, were held for auxiliaries.

The total number of individuals trained by DTLRC was 832, including physicians, nurses, laboratory technicians and auxiliaries.

**Teaching materials.** Adequate teaching material was created at the outset of DTLRC, as outlined below.

- A technical manual was produced for the health professionals intervening in the campaign. Illustrative placards were prepared and these were used to summon the population to information meetings (Fig. 2).
- The teaching material to inform the public during site visits included a series of posters and sets of slides, which described the natural history of leishmaniasis, its clinical evolution, and the therapeutic and prophylactic options.
- Illustrated calendars were widely distributed to the population in the campaign area and specific bulletins were produced for patients under treatment.
- During the second year of the campaign, regular radio programmes in three languages (Spanish, Aymara and Quechua) were broadcast for the general public.

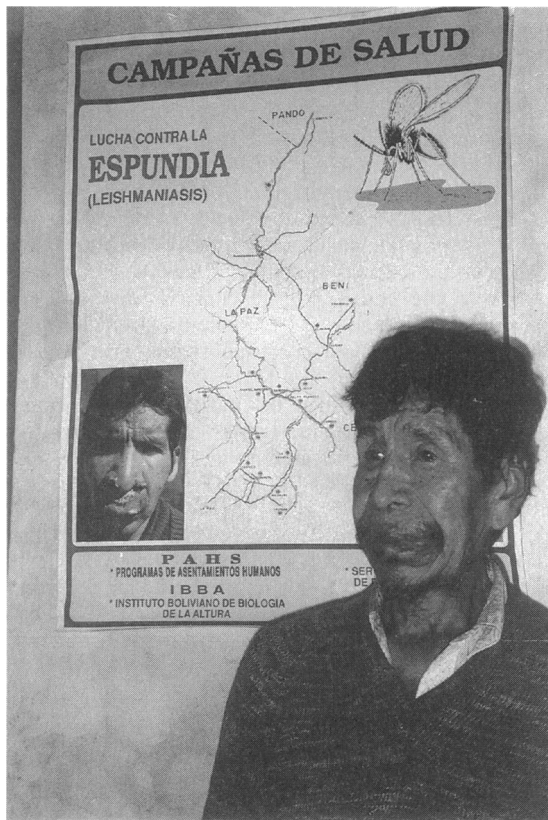
## **Results**

### **Information campaign**

Each sector was visited by personnel from the participating organizations who provided information to the public: general meetings were held after they had been announced on posters and radio programmes, and door-to-door individual visits were also made.

The real impact of the campaign is difficult to evaluate. No assessment was made for the population covered. However, during the third year of the campaign, there were indications that it had had an

Fig. 2. A patient standing in front of a poster used to announce the information meetings during the campaign.



impact at the local level: in particular, many patients presented spontaneously to the diagnosis and treatment centres. It is estimated that about 80% of the population living in the endemic areas are aware of leishmaniasis and know where to present if they are infected. Moreover, the campaign also had a national impact, as evidenced by the requests made by various departments in the country to be included in DTLRC activities.

**Detection of cases**

The detection of cases was both active and passive. Cases were detected directly during the campaign visits and information meetings held in the settlements, the infected patients being sent to the relevant diagnosis and treatment centre for diagnostic confirmation. The number of infected patients who spontaneously presented to the centres increased regularly; however, in compiling the results, the type

of detection was not differentiated, since the campaign's objective was to reach the maximum number of infected persons.

In cases of cutaneous leishmaniasis, the diagnosis was made on the basis of the clinical aspect of the lesions. Evidence of parasites on Giemsa-stained smears was sought. Because of the low positivity rates with mucosal cases (13), the diagnosis was based on both an anterior cutaneous lesion and the presence of granulomatous and/or ulcerative lesions of the nasal and/or buccal mucosae (14).

Between August 1989 and December 1990 the campaign resulted in the detection of a total of 849 cases of MCL, of which 492 were cutaneous and 105 mucosal forms (Table 1). The remaining 252 cases were "intermediate" (i.e., patients had a scar indicative of cutaneous leishmaniasis, but without any current mucosal involvement). Inclusion of only active cases (cutaneous + mucosal) gives an annual incidence of 0.96 per 100 in Alto Beni/Beni.

During 1991, a total of 1432 cases of MCL were detected, of which 787 were cutaneous, 115 mucosal, and 530 intermediate (Table 1). Considering again only the active cases, the annual incidence for Alto Beni/Beni/Yungas was 0.64 per 100.

In 1992, a total of 1004 cases were detected, corresponding to 873 cutaneous, 106 mucosal, and only 25 intermediate (Table 1) (annual incidence, 0.70 per 100).

**Treatment of cases**

Based on published data (15, 16) and the experience acquired at the Hospital de Clinicas, La Paz, the therapeutic schemes outlined below were defined.

- Cutaneous forms were treated using intramuscular injections of meglumine antimoniate (dose, 20 mg Sb kg<sup>-1</sup>.day<sup>-1</sup>) for 20 days (17). The treatment was ambulatory, the patient attending daily for an injection at the MCL centre for diagnosis and treatment. If distance prevented the daily return of the patient to such a centre, the complete treatment was delegated to a health centre closer to his/her home. In this case,

Table 1: Number of cases of mucocutaneous leishmaniasis detected by DTLRC in Bolivia, 1989-92<sup>a</sup>

	No. of cases:			
	Cutaneous	Mucosal	Intermediate	Total
1989	89	26	10	125
1990	403	79	242	724
1991	787	115	530	1 432
1992	873	106	25	1 004
Total	2 152	326	807	3 285

<sup>a</sup> DTLRC = Diagnosis and Treatment of MCL, Rural Campaign.

## Diagnosis and treatment of mucocutaneous leishmaniasis in Bolivia

the control of the treatment was under the responsibility of the local health centre, which returned the empty ampoules to DTLRC at the end of the treatment.

- Patients affected with mucosal forms of MCL were hospitalized, and after haematological and renal function tests had been carried out, were treated with amphotericin B dissolved in 500 ml of a 5% glucose solution, to which was added 1 mg dexamethasone. The solution was infused intravenously over 6–8 hours. For adults, the dose of amphotericin B was progressively increased up to 50 mg, by perfusion; three doses were administered per week—the complete treatment consisting of 45 doses (2.25 g amphotericin B).

- In intermediate forms, a conservative approach was adopted. Patients were recommended to consult one of the MCL centres once a year for examination.

Over the period August 1989 to December 1990, the total number of cases treated was 356, of which 298 were cutaneous and 58 mucosal (Table 2). During 1991 the number of cases treated reached 695, of which 629 were cutaneous and 66 mucosal. During 1992, the number of cases treated was 837, of which 750 were cutaneous and 87 mucosal (Table 2). The increase in the number of mucosal cases treated reflects the slow establishment of amphotericin B treatment under field conditions. Also, the regular increase in the proportion of treated patients per detected case (Table 2) provides an additional measure of the benefit of the campaign.

**Table 2: Number of cases of mucocutaneous leishmaniasis treated by DTLRC in Bolivia, 1989–92<sup>a</sup>**

	No. of cases treated:	
	Cutaneous	Mucosal
1989	79 (88.8) <sup>b</sup>	13 (50.0)
1990	219 (54.3)	45 (57.0)
1991	629 (79.9)	66 (57.4)
1992	750 (85.9)	87 (82.1)
<b>Total</b>	<b>1 677 (77.9)</b>	<b>211 (64.7)</b>

<sup>a</sup> DTLRC = Diagnosis and Treatment of MCL, Rural Campaign.

<sup>b</sup> Figures in parentheses are percent of the number of cases detected.

The efficiency of the treatments can be considered to have been good in both cutaneous and mucosal forms (Table 3), confirming the validity of the diagnosis. In both forms of the disease, the follow-up of the patients was excellent, with the proportion of patients lost to treatment being no greater than 1.4% (cutaneous cases). Treatment of the cutaneous form was interrupted because of side-effects in 4.1% of cases; failure of the standard series of meglumine antimoniate occurred in only 1.3% of cases, all of whom received a second course. Further reactivation occurred in only 0.7% of cases.

For the mucosal form, interruption of amphotericin B treatment was more frequent (10.4% of cases), but the proportion of failures and further reactivation was low (0.5%).

The total quantities of drugs used by DTLRC were 125 000 ampoules of meglumine antimoniate and 12 500 ampoules of amphotericin B.

**Table 3: Results of the treatment of cutaneous and mucosal cases of leishmaniasis by DTLRC in Bolivia, 1989–92<sup>a</sup>**

Year/form of leishmaniasis	No. of cases treated	No. of interrupted treatments	No. of cases cured	No. of treatment failures	No. of reactivated treatments	No. of uncontrolled patients
<b>1989</b>						
Cutaneous	79	1	74	—	—	4
Mucosal	13	—	13	—	—	—
<b>1990</b>						
Cutaneous	219	9	210	—	—	—
Mucosal	45	6	39	—	—	—
<b>1991</b>						
Cutaneous	629	18	587	11	4	9
Mucosal	66	9	55	1	1	—
<b>1992</b>						
Cutaneous	750	40	682	10	7	11
Mucosal	87	7	79	—	—	1
<b>Total</b>						
Cutaneous	1 677	68	1 553	21	11	24
Mucosal	211	22	186	1	1	1

<sup>a</sup> DTLRC = Diagnosis and Treatment of MCL, Rural Campaign.

## **Evaluation of the campaign**

From the beginning of the campaign, evaluation meetings were held regularly, at central and local levels, with the participation of the organizing bodies. Over the period August 1989 to December 1990, eight evaluation meetings were held (two at central level and one in each campaign sector). In 1991 and 1992, three general meetings and six local meetings per sector were organized annually.

## **Discussion**

The DTLRC campaign, run over the period 1989–92 in the La Paz and Beni Departments of Bolivia, is an intervention strategy that could be extended to other countries. Also, although its strategy was directed towards a particular disease that is difficult to control, its design is suitable for solving general public health problems.

The objective of DTLRC was not to control leishmaniasis in the areas where it operated, since this would have been impossible for a wild zoonosis in a tropical rain forest area, maintained through unknown sylvatic reservoirs. Instead, an intervention strategy was developed, based on public education.

The information provided by DTLRC focused on the nature of the disease, its transmission modalities, the risk of mucosal involvement, and early treatment as a means of preventing facial mutilations. The campaign also provided training for health professionals in the endemic areas, including physicians, nurses, laboratory technicians, and health auxiliaries.

As a result of the campaign, 3285 cases of leishmaniasis were detected of which 1888 were treated, (1677 cutaneous and 211 mucosal forms). The treatments were dispensed in the endemic zone, using medical and laboratory standards similar to those available in La Paz and Santa Cruz, the two urban centres in Bolivia where leishmaniasis treatment is available. The low proportion of mucosal cases treated was related to the lack of hospital facilities in the diagnosis and treatment centres. The efficacy of the treatments was good, with high cure rates for both forms.

The coverage and response of those covered by the campaign, particularly in terms of compliance with treatment, depended on the population categories: coverage was optimum among the colonists but was low among the native Chimanés and Mosetenes populations.

DTLRC had a twofold impact on the population: at the individual level, it increased understanding about leishmaniasis and the need for early diagnosis and compliance with treatment. Also, the campaign

alerted health authorities in Bolivia to the problems posed by leishmaniasis and prompted them to take action; precise statistics about MCL were obtained for an area where they were previously nonexistent.

The intrinsic weakness of the campaign is that it was privately run and supported financially by a foreign donor and not taken over by the official Bolivian health structures.

DTLRC should be continued and MCL should be considered by the national authorities in Bolivia to be a major health problem in the settled areas. Official bodies should assume responsibility for the campaign and it should be extended to other endemic areas not previously covered (Franz Tamayo, Iturralde and Vaca Diez provinces), as well as to other diseases, such as tuberculosis and intestinal parasitosis.

## **Acknowledgements**

The campaign was financed by PL 480-USAID Bolivia. We are especially grateful to Mr C. Brockman and Dr R. Zumarán, PL 480-USAID; and Mr P. Hartenberger and Dr J. Kuritsky, USAID, Bolivia. All personnel of the participating organizations who acted to ensure the success of DTLRC are thanked. The Instituto Boliviano de Biología de Altura (IBBA) receives financial support from the French Ministry of Foreign Affairs, the Bolivian Ministry of Public Health, and the University Mayor de San Andrés, La Paz. Dr R.N. Davidson is thanked for revising the manuscript.

## **Résumé**

### **Campagne rurale de diagnostic et de traitement de la leishmaniose cutanéomuqueuse en Bolivie**

La leishmaniose cutanéomuqueuse (LCM) est endémique dans les terres basses amazoniennes de Bolivie, vers lesquelles migrent régulièrement les populations altiplaniques. Zoonose sylvatique sauvage dont les réservoirs demeurent inconnus, la LCM représente un important problème de santé publique pour ces populations implantées, qui méconnaissent la maladie et s'installent dans des régions médicalement sous-équipées.

Dans ce contexte épidémiologique défavorable, les auteurs rapportent un exemple de stratégie d'intervention mise en place à l'initiative d'organisations non gouvernementales: la campagne rurale de diagnostic et traitement de la LCM, qui a été développée à partir d'août 1989 dans les régions boliviennes des Yungas, de l'Alto Béni et du Béni.

L'objectif principal était d'assurer un dépistage massif de l'affection, avec diagnostic précoce et traitement dans des conditions équivalentes à celles rencontrées dans les centres urbains de la Paz et Santa Cruz, et ce directement dans les zones d'endémie.

La décentralisation exécutive de la campagne a été assurée grâce à la création de 5 centres locaux de diagnostic et de traitement, base opérationnelle pour l'enquête de dépistage dans le secteur.

La campagne a également permis la formation du personnel médical et paramédical exerçant dans la zone (832 professionnels de la santé formés) et une information de la population vivant dans la zone.

Durant trois ans et demi de campagne, 3285 cas de LCM ont été détectés, dont 2152 cas cutanés, 326 cas muqueux et 807 cas intermédiaires.

L'incidence annuelle de la LCM dans les zones couvertes par la campagne était comprise entre 0,64 et 0,96 pour 100 suivant l'année. Parmi les cas détectés, un total de 1888 personnes ont été traitées (soit 57,5% des cas détectés) dont 1677 cutanés et 211 cas muqueux. L'efficacité des traitements a été bonne.

L'impact de la campagne a été important, tant au niveau local, sur les populations exposées, qu'au niveau national.

## References

1. **Vianna G.** [A novel species of *Leishmania*: preliminary note]. *Brasil Médico*, 1911, **25**: 411 (in Portuguese).
2. **Marsden PD.** Mucosal leishmaniasis ("Espundia" Escomel, 1991). *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1986, **80**: 859-876.
3. **Dedet JP.** *Leishmania* et leishmanioses du continent américain. *Annales de l'Institut Pasteur-Actualités*, 1993, **4**: 3-25.
4. **Shaw JJ, Lainson R.** 7. Ecology and epidemiology: New World. In: Peters W, Killick-Kendrick R, eds. *The leishmaniasis in biology and medicine*. New York, Academic Press, 1987: 291-363.
5. **David C et al.** Fifteen years of cutaneous and mucocutaneous leishmaniasis in Bolivia: a retrospective study. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1993, **87**: 7-9.
6. **Torrez Espejo M et al.** Epidémiologie de la leishmaniose tégumentaire en Bolivie. 1. Description des zones d'étude et fréquence de la maladie. *Annales de la Société belge de Médecine tropicale*, 1989, **69**: 297-306.
7. **Marinkelle CJ.** The control of leishmaniasis. *Bulletin of the World Health Organization*, 1980, **58**: 807-818.
8. **Saf'janova VM.** Leishmaniasis control. *Bulletin of the World Health Organization*, 1971, **44**: 561-566.
9. *Control of the leishmaniasis. Report of a WHO Expert Committee*. Geneva, World Health Organization, 1990 (WHO Technical Report Series, No. 793).
10. **Desjeux P et al.** Les *Leishmania* de Bolivie. I. *Leishmania braziliensis* Vianna 1911 dans les départements de La Paz et du Béné. Premiers isolaments de souches d'origine humaine. Caractérisation enzymatique. In: Rioux JA, ed. *Leishmania. Taxonomie et phylogénèse. Applications éco-épidémiologiques*. Montpellier, I.M.E.E.E., 1986: 401-410.
11. **Revollo S et al.** Isoenzyme characterization of *Leishmania braziliensis braziliensis* isolates obtained from Bolivian and Peruvian patients. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 1992, **86**: 388-391.
12. **Walton BC, Valverde L.** Racial differences in espundia. *Annals of tropical medicine and parasitology*, 1979, **73**: 23-29.
13. **Dimier-David L et al.** Parasitological diagnosis of mucocutaneous leishmaniasis due to *Leishmania b. braziliensis* in Bolivia. *Revista da Sociedade Brasileira de Medicina Tropical*, 1991, **24**: 231-234.
14. **Dimier-David L et al.** Particularités épidémiologiques, cliniques et biologiques de la leishmaniose cutanéomuqueuse en Bolivie d'après un échantillon de 221 malades. *Bulletin de la Société de Pathologie exotique*, 1993, **86**: 106-111.
15. **Franke ED et al.** Efficacy and toxicity of sodium stibogluconate for mucosal leishmaniasis. *Annals of internal medicine*, 1990, **113**: 934-940.
16. **Marsden PD et al.** High continuous antimony therapy in two patients with unresponsive mucosal leishmaniasis. *American journal of tropical medicine and hygiene*, 1985, **34**: 710-713.
17. **Herwaldt BI, Berman JD.** Recommendations for treating leishmaniasis with sodium stibogluconate (Pentostam) and review of pertinent clinical studies. *American journal of tropical medicine and hygiene*, 1992, **46**: 296-306.