

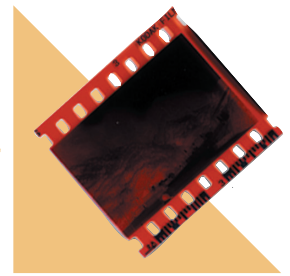


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Foreign Aid Project –  
The Sao Tome and Principe Malaria Control Program





Sao Tome and Principe's international airport - President Fradique de Menezes welcomes President Chen Shui-bian by the military salute

## I. Origin of the Project

While on a visit to Taiwan's African diplomatic ally, the Democratic Republic of Sao Tome and Principe, on July 4, 2002, President Chen Shui-bian reached an agreement with the nation's president and health minister to cooperate on a malaria control program. Accordingly, on December 2 of the same year, the health minister of Sao Tome and Principe headed a delegation to Taiwan, where a bilateral meeting was held with the CDC. During the meeting, it was decided that Taiwan would draw up a plan for malaria control and assist the African nation in its antimalaria activities. To integrate professional and administrative resources from various parties, the Ministry of Foreign Affairs (MOFA) deliberated on issues raised by both the CDC and relevant experts to draw up a plan whose implementation was entrusted to the International Economic Cooperation Development Fund (ICDF).

## II. Project Duration

Three years, from July 1, 2003, to June 30, 2006.

## III. Project Objectives

To assist Sao Tome and Principe in the establishment and launch of applicable models for the control of malaria vector mosquitoes and for diagnosis and treatment, with the aim of reducing morbidity and mortality rates.

## IV. Main Operations

- (I) Establishing a model for the control of vector mosquitoes
  1. Conducting investigation, surveillance and analysis of vector mosquito index and drug resistance.
  2. Performing vector mosquito controlling drug trials in priority areas.
- (II) Conducting large-scale vector mosquito elimination and surveillance



Delegates from eight Portuguese-speaking countries visit Taiwan's Malaria control team



The Sao Tome and Principe Malaria control team

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- (III) Establishing an appropriate model for diagnosis and treatment
  - 1. Improving the ability to diagnose malaria.
  - 2. Surveying and evaluating the drug resistance of malaria patients.
  - 3. Establishing and popularizing malaria treatment principles.
  - 4. Monitoring and analyzing the drug resistance of malaria parasites.
- (IV) Surveying and evaluating epidemiological data on malaria prevalence, morbidity rates and mortality rates
- (V) Training relevant personnel and disseminating health education information

## V. Content of the Project

### (I) Establishment of a model for the control of vector mosquitoes

#### 1. Surveillance and analysis of vector mosquito indices

- (1) Surveillance of vector mosquito species.
- (2) Monitoring of vector mosquito indices.
  - A. Mosquito light traps
  - B. Human-bait traps
- (3) Monitoring of larval density.

#### 2. Vector mosquito controlling drug trials in priority areas

Conducting a drug resistance survey prior to the launch of large-scale vector mosquito control operations, with the objectives of testing the suitability of drug types, concentration used, and method of application, and of gaining insight into the level of acceptance and cooperation of the people of Sao Tome and Principe, so as to serve as reference for the planning of subsequent large-scale spraying operations.



Field collection and investigation of Anopheles mosquitoes

### (II) Large-scale vector mosquito elimination and surveillance

Based on the results of the aforementioned trial, this operation carries out large-scale application of vector mosquito control drugs throughout Sao Tome and Principe, with subsequent continued monitoring in associated index variations.





Bioassay of Anopheles mosquitoes' drug resistance



### (III) Establishment of an appropriate model for diagnosis and treatment

#### 1. Improving the ability to diagnose malaria

- (1) Strengthening of the diagnostic system of traditional laboratory microscopic examination in SaoTome and Principe.
- (2) Introduction of commercialized immunoassay reagents for capturing malaria parasite antigen.

#### 2. Surveying and evaluating the drug resistance of malaria patients (molecular epidemiology).

Testing and evaluating applicable antimalarial drugs for Sao Tome and Principe, and analyze the symptoms and relevant medical indices of malaria patients after treatment to serve as reference for assisting Sao Tome and Principe to build a standard model for malaria diagnosis and treatment.



Ambassador accompanies Health Minister to visit ROC malaria control team stationed in the Sao Tome and Principe

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## 3. Establishing malaria treatment principles

- (1) Establishment of standards for first and second line drug treatments.
- (2) Establishment and publicization of treatment guidelines for malaria with and without complications.
- (3) Establishment and publicization of precautions and protocols for pregnant women and unimmunized persons.

## (IV) Surveillance and evaluation of epidemiological data on malaria prevalence, morbidity rates and mortality rates.

1. Survey of relevant indices nation-wide (in collaboration with the Ministry of Health of Sao Tome and Principe).
2. Evaluation of results of the program (this operation is conducted by Taiwan with the collaboration of the Ministry of Health of Sao Tome and Principe).
3. Research and investigation into relevant tropical medicine.

## (V) Training of relevant personnel and dissemination of health educational information

To facilitate the implementation of the main operations of the program, the relevant antimalaria personnel of Sao Tome and Principe have been trained to participate in the program, and they are divided into the following five categories:

1. Health education and publicity personnel.
2. Vector mosquito control operation personnel (for trapping mosquitoes, spraying, and monitoring activities).
3. Diagnostic technicians in laboratory and in the clinical field.
4. Public health personnel (including those involved in epidemiological investigations).
5. Technicians of vector mosquito ecology research.

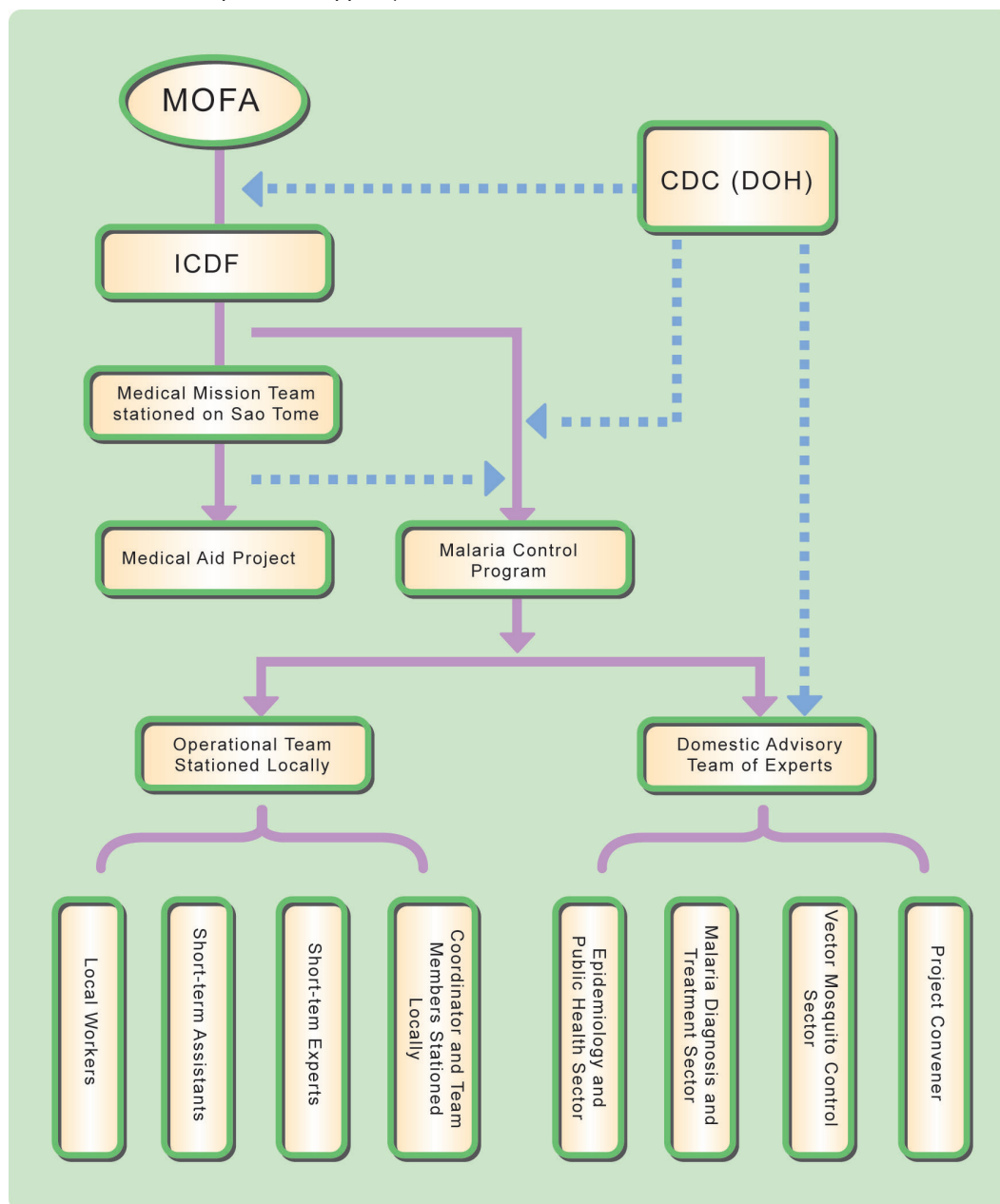


Investigation of malarial infection rate in children at village in Sao Tome and Principe.



## (VI) Project Implementation Structure Organization Chart

(Solid lines represent relationships of subordinate authority. Dotted lines represent relationships of administrative or specialist support.)



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## VI. Preliminary Report on the Effectiveness of Controlling Efforts on Principe

Malaria is the most serious parasitic disease in the world, with the largest number of patients. Every year, 3.5 to 5 billion people are infected with malaria, 80-90% of whom are in Africa, making it a major health issue on the continent (1,2). The Sao Tome and Principe Malaria Control Program is focused on the control of vector mosquitoes. Since restrictions were placed on the use of DDT, the control of vector mosquitoes has become the main obstacle to malaria control work.

To lower the level of malaria morbidity and mortality, African nations have adopted the strategies of early treatment and protection against mosquitoes but with limited results. The primary anti-mosquito method is to promote the use of bed nets, particularly insecticide-treated bed nets (ITNs), which have significantly reduced the number of cases in some areas (3), although the final results remain to be seen.

The principal strategy of the Sao Tome and Principe Malaria Control Program is to control vector mosquitoes. In addition, parasitologists are studying the therapeutic efficacy of antimalarial medications, while epidemiologists are evaluating the epidemiological changes, such as morbidity and mortality levels. The control of vector mosquitoes is carried out by complete indoor residual spraying with *á*-cypermethrin. The spraying operations are directed by entomologist Professor Lien Jih-chin, while therapeutic efficacy, with pregnant women as its main study subjects, is overseen by Dr. Hung Jih-chin, and the epidemiological investigation was designed by Professor Sung Fung-chang.

During the 1991 outbreak of dengue fever in southern Taiwan, Dr. Lien used *á*-cypermethrin for indoor residual spraying in high risk areas to control vector mosquitoes (4, 5). For the operation, a trial on residual effects was conducted in advance, using drugs containing 1.5% *á*-cypermethrin to spray polymer sheets coated with plastic, plain polymer sheets or kraft paper to achieve per square meter coverage of 50 mg, 30 mg and 20 mg respectively for testing purposes. Mosquito specimens were obtained from Bora Boral, Hungmaokang, Linyuan, Kaohsiung City and the Ryukyu Islands for testing. The efficacy of the method varied from 84% to 100%, with residual effect lasting as long as 424 days. This forms the background of Professor Lien's proposition for using *á*-cypermethrin in Sao Tome and Principe.



ROC malaria control team in the Sao Tome and Principe check on the spray pesticide record

As a matter of fact, African nations have already begun processing insecticide-treated bed nets with *á*-cypermethrin in their control of vector mosquitoes, to prevent residents from becoming infected with malaria. The study in Kenya shows that the method can lower the hospital visit rates of children by 27% ( from 37% to 10%) (3). The main vector mosquito species present in Sao Tome and Principe are *Anopheles gambiae* (*An. gambiae*), *Aedes aegypti* (*Ae. aegypti*) and *Culex quinquefasciatus* (*Cu. quinquefasciatus*).



The anti-mosquito activities in Sao Tome and Principe began with a survey of vector mosquitoes, with the Sao Tome and Principe's Center of Infectious Diseases conducting surveys on anopheline larval density in different areas since March 2003, while bioassay trials on residual spraying with á-cypermethrin were carried out under Professor Lien's directions. When the drug was applied separately on wood and concrete walls, a version containing 15% of á-cypermethrin yielded by far the best results (mosquito mortality rate was 90-100% against 30-90%).

The Democratic Republic of Sao Tome and Principe, composed of Sao Tome Island and Principe Island, has a total land area of approximately 1,001 square kilometers and is situated in the Atlantic Ocean 220 kilometers from the west coast of Africa, with a population of approximately 138,000, of whom more than half are minors. Principe is the smaller of the islands, with a population of 6,000. Registered deaths within the Aug a Graude district of Sao Tome and Principe, from 2000 to 2002, were used to analyze the leading cause of mortality among children under six years old. Over the period of three years, there had been 1179 mortality cases, with stillbirths and infant mortality accounting for 13.6% and 44% respectively; the leading causes of mortality among children under six years old were malaria (24.2%), followed by malnutrition/anemia (22.0%) and obstetric events (15.0%), while mortality caused by respiratory tract diseases and diarrhea was at 8.8% and 5.0% respectively. Among the 285 mortality cases, 40% were infants and 26% were 12-23 months old, which clearly demonstrated the severity of malaria. 7-14-2005

After the residual spraying trial was completed, the pilot operation of vector mosquito control was immediately set in motion in Sao Tome and Principe. The design of the control trial included three comparative studies: 1. Conducting residual spraying trial with á-cypermethrin, which was applied to the households in Riberia Afonso on Sao Tome, in addition to island-wide application to the households on Principe. Booster spraying was also conducted on Principe in November 2004. 2. Applying outdoor insect growth regulators (IGR) in Praia Gamboa on Sao Tome to suppress larvae living in the water from developing into adults. 3. Applying outdoor spraying of organophosphate insecticide (containing 100 of grams primiphos-methyl per 100 kilograms), once in August and once in October, in Micolo. The Angolares area was set as the control area for comparison.

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To follow-up on the efficacy of the pilot trial in vector mosquito control, copies were made of case histories at hospitals and health stations; based on the malaria cases found at each locality, comparisons were made before and after the intervention on malaria prevalence (on Principe) or on the malaria-positive screening rates recorded in patient histories (in other testing areas). On Principe, the island-wide indoor residual spraying of households with á-cypermethrin achieved the best results, and malaria cases fell from 3,063 in 2002 (or 2,579 in 2003) to 959 in 2004. The application of IGR in Praia Gamboa also achieved good results, with malaria-positive screening rates down to 37.5% from 76.2%; but no regular pattern has been discerned in the other three areas.

The Sao Tome and Principe Malaria Control Program is progressing well, and island-wide household spraying operation has begun on Sao Tome this summer. It is anticipated that effects equal to those on Principe will be achieved.

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