

Reprinted from the PROCEEDINGS OF THE FORTY-SECOND ANNUAL MEETING
OF THE NEW JERSEY MOSQUITO EXTERMINATION ASSOCIATION,
ATLANTIC CITY, NEW JERSEY, MARCH 9-11, 1955.

Received By
DEPT. OF HEALTH, EDUCATION & WELFARE
PUBLIC HEALTH SERVICE
DIVISION OF INTERNATIONAL HEALTH
WASHINGTON, D. C.

MOSQUITO CONTROL AND INTERNATIONAL HEALTH

DONALD R. JOHNSON

In the United States, mosquito control programs are being conducted in many areas. However, outside of the control of vectors of the various encephalitides, health is not the major concern in most of these control programs. Yellow fever was eradicated from this country many years ago, although the vector, *Aedes aegypti*, is still present in the southern United States. Dengue and filariasis present no health threat and malaria is no longer a problem. This does not mean that mosquitoes should not be controlled if no mosquito-borne diseases are present. There can be no

¹Entomologist, Division of International Health, Public Health Service, U. S. Department of Health, Education and Welfare, Washington 25, D. C.

argument that pest mosquitoes can seriously affect the economics of an area and make life miserable both for man and beast.

On the other hand, many of us who are engaged in mosquito control activities have forgotten that mosquitoes are or can be a serious menace to the health of a population. In some areas the health threat is over-emphasized, perhaps in order to obtain funds for pest control programs. In the United States, mosquitoes do not ordinarily endanger the health or transmit diseases which cause the death of hundreds of thousands of people. This is not a criticism of our control programs but rather is a real compliment because mosquito control has been perfected to a stage in this country where mosquito-borne diseases are at the lowest incidence ever experienced in our history. The type of pest mosquito control known in the United States is in one sense a luxury and is unknown in most other countries of the world.

However, we would not have to go very far from the United States for an example of what mosquito control means to health programs. In Mexico, we would learn that the Mexican Government is spending \$12,000,000 in an attempt to eradicate malaria from that country. In 1954, a few cases of yellow fever occurred in Trinidad, thereby resulting in an estimated \$23,000,000 loss to that one island before the outbreak was brought under control. This loss was due to the virtual cessation of tourist trade and the closing of seaports to international shipping in that country. If we were then to travel on to Indonesia, we would find that 40% of the people there live in malarious areas and that the cost of quinine suppression of malaria is more expensive than virtual elimination of malaria by the application of residual insecticides. In India, there were formerly 2,000,000 deaths annually because of malaria plus millions of others incapacitated by malaria and also filariasis. Similar instances can be cited for many other economically underdeveloped countries throughout the world. Coexistence between happy, healthy people and uncontrolled populations of *Anopheles* vectors of malaria is difficult to comprehend. Good international health, especially in tropical countries, is almost impossible without effective mosquito control. Our Government is now providing direct mosquito vector control assistance, particularly through malaria control aid, to millions of persons in Asia and other countries.

The questions that many of us may ask is how did the United States get into the international mosquito control programs and what are we accomplishing? During World War II we were forced by circumstances into overseas malaria and mosquito control programs because of the deployment of our troops into many tropical areas. In Guadalcanal the toll from malaria was almost disastrous. Our troops in Samoa contracted many cases of filariasis from the mosquitoes there. Many of our men were incapacitated by dengue fever in New Guinea. We soon learned, thanks to the new insecticide DDT, that these diseases could be controlled. For the first time in history, rapid and effective control could readily be initiated even under difficult field conditions.

After World War II, the United Nations and its various agencies were founded. The World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF) became active in malaria control programs because malaria was recognized as one of the most serious public health problems in so many countries of the world. Control had been proven possible and feasible by the use of residual insecticides, and pilot demonstration projects were started in many countries.

Both WHO and UNICEF are multilateral in their operation. That is, they are financed by the governments of many countries, including the United States. Through international cooperation these agencies were and are able to demonstrate the practicability of malaria control operations to various individual member countries. WHO provided technical experts to the various countries involved in these control programs, and UNICEF provided the insecticides and other necessary commodities.

In 1948, the Marshall Plan for European recovery was inaugurated. Other aid plans have gradually extended U. S. technical know-how to many other countries of the free world. At the present time, the Foreign Operations Administration (FOA) administers the programs originally operated through the Economic Cooperation Administration, the Mutual Security Agency and the Technical Cooperation Administration. The Institute of Inter-American Affairs also is incorporated into the Foreign Operations Administration. The FOA is a bilateral agency which extends United States aid to individual countries and has no direct connection with the WHO or other UN agencies, although malaria control programs are carried out cooperatively in many countries, particularly in Asia.

Malaria control is one of the top priority public health programs being financed by FOA. When carefully analyzed, malaria control is shown to be a technically and administratively feasible program because of the comparative ease of organizing malaria control activities. The results obtained from residual house spraying are readily recognizable soon after application of the insecticides upon which most of these programs are based. Many persons are directly affected and the costs are relatively low, often averaging 15 to 25 cents or even less per capita per year. Excellent malaria control is the usual result and it is doubtful whether any other public health program in tropical countries can show such remarkable returns for comparable amounts of money expended. Also it is possible for the countries to take over these programs themselves after the organization has been completed and indigenous technicians are either trained or made available.

At the present time, DDT is the major insecticide being used for malaria control. However, dieldrin also is being utilized in many countries, particularly where transportation problems pose difficulties or where DDT-resistant mosquitoes have been encountered. Wettable powder formulations of these two materials are preferred because they have proven to be most effective on the wall surfaces encountered, least toxic to humans, and most easily transported into the field.

At the present time, it is estimated that approximately 145,000,000 persons in Asia are being protected against malaria in programs receiving FOA assistance. The largest of these is in India where more than 110,000,000 persons are now protected. Other important FOA-supported programs include Indonesia, Indochina,* Iran, Nepal, Pakistan, Philippine Islands, Taiwan, and Thailand. A small program is in operation in Liberia and a program is to be started in the near future in Ethiopia.

In 1954, a rather remarkable control operation was carried out in Pakistan. Floods were encountered in that country and an urgent appeal for medical relief was cabled to the United States by the American consul in Dacca, East Pakistan. Within several days after receiving the request, U. S. Public Health Service personnel were en route to Pakistan to be of assistance for the post-flood epidemics which were anticipated. U. S. Air Force planes were dispatched carrying tons of FOA-purchased health supplies. Included in these shipments were 10 tons of dieldrin wettable powder and 250 hand compression sprayers. More than 30,000,000 anti-malarial tablets were also dispatched to East Pakistan. In approximately two weeks after the original appeal was sent from Pakistan, the materials were in Pakistan, along with malaria technicians for the proposed mosquito control activities. This dramatic operation demonstrates the ability of the United States to initiate emergency vector control programs in distant parts of the world on very short notice. It also shows the attitude of our Government toward the importance of insect control activities as an aid to good public health measures.

In the Western Hemisphere, the Pan American Sanitary Bureau, which acts as the regional office of WHO, is actively promoting a malaria eradication program for this hemisphere. It is also vitally interested in the control of *Aedes aegypti* because of the gradual northward spread of yellow fever through Central America. Although FOA is extremely interested in control programs of this type, it assumes only a minor role in these programs in the Americas. The Pan American Sanitary Bureau estimates that 135,000,000 persons in South America live in the so-called "malaria zone" and only 30,000,000 of these persons are now unprotected from malaria. Every effort is being made to extend protection to all persons in the Americas as soon as possible in order that control will be effected before the development of insecticide resistance by vector mosquitoes.

Anopheline resistance to insecticides is a real health threat in at least two malarious areas of the world, namely Greece and Indonesia. In Greece the problem of *Anopheles sacharovi* resistance to chlorinated hydrocarbons is presenting a threat to their present control activities. In Indonesia, DDT resistant *Anopheles sundaiicus* are being effectively controlled by dieldrin. In Taiwan *Culex quinquefasciatus* (= *fatigans*), a filariasis vector, appears to be resistant to both DDT and dieldrin. Additional research is needed to give practical answers to the resistance

*Cambodia, Laos and Viet Nam.

problems because the success of mosquito control programs in many countries is at stake.

Although remarkable or even sensational results are being obtained in the international mosquito control programs at present, we do not know what the future may bring. The malaria eradication programs being promoted by WHO are basically sound but there may be many pitfalls ahead. It may not be possible for some of the countries involved to absorb the intensive type of control work which will be necessary to obtain malaria eradication. However, I feel that every effort should be made to achieve this goal. The health and very lives of millions of people are at stake and outside support of these programs is essential. Our Government is providing aid to approximately half of the persons known to live in malarious areas in free countries of Asia but the most difficult stages of control may be ahead. Control work has been carried out in the areas most accessible and where programs could be most feasibly initiated. Insecticide resistance has not been the menace in the past that it may be in the future.

Better international health through proper mosquito control on this ever-shrinking globe vitally concerns everyone of us. Malaria control is one of the most effective means of improving the health of these peoples and U. S. assistance is still essential to continued success of these programs in economically underdeveloped countries. The WHO and other UN agencies, all of which receive United States support, have very limited budgets and cannot actively assist all the necessary control activities. Unless we continue to grant aid by providing technical assistance and provision of certain commodities, these activities may fail. For the cost of two or three jet bombers, we are making possible international malaria control programs which are unprecedented in the history of the world.

SUTPHEN: Are there any questions? Our next speaker will be our immediate past president, Charles Foulk, who will speak as a representative of the New Jersey League of Municipalities. Mr. Foulk was also supposed to give a talk tomorrow as a commissioner from Essex County. Because of a change in program we have asked Mr. Foulk to give both of these papers this afternoon. Charlie —