

# Controlling Malaria in Mexico Using Alternatives to DDT



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*John Eberlee*

[Photo: Individual risk factors for malaria infection are determined using rapid blood tests carried out by health promoters. See slide show: [Controlling malaria in Mexico using alternatives to DDT](#)]

Public health experts in Mexico, in collaboration with the nation's Malaria Control Programme (MCP), are introducing new strategies to prevent malaria outbreaks — without the help of DDT.

A multi-disciplinary team funded by the International Development Research Centre (IDRC) is using an ecosystem health approach to fight malaria in the State of Oaxaca — the main site of malaria outbreaks in Mexico. Investigators are looking at ways to manage the local environment to reduce the incidence and spread of malaria.

"We're looking at malaria from many different angles including the molecular biology of the vector and the parasite, community perceptions of malaria, statistical analyses, and a geographic information system (GIS)-based surveillance system," says [Juan Hernandez](#), Director of Informatics at the National Institute of Public Health ([Instituto Nacional de Salud Pública](#)).

## Long-term goal

The MCP's long-term objective is to prevent future outbreaks of malaria, without harming the local environment. Since the 1940s, DDT has been the weapon of choice against malaria, but the chemical is a persistent organic pollutant that builds up in animal tissues. DDT is known affect reproduction in wildlife and, at high enough levels, to damage the human nervous system.

Malaria is most prevalent on Mexico's two coasts. Over the past 50 years, there have been periodic outbreaks of the disease, including more than 140,000 cases in 1985, which authorities controlled using a program of massive DDT spraying and anti malarial therapy. In the years that followed, malaria incidence rates fell quickly, and the malaria control program was ended in 1993-94. However, a hurricane in 1998 devastated the coastal environment of Oaxaca, causing another outbreak of 14,000 cases and triggering a search for new, community-based approaches to malaria control.

## GIS mapping

Under the IDRC project, the research team used GIS tools to characterize different localities in the Pochutla area of Oaxaca, in terms of malaria incidence and prevalence, elevation, climate, hydrology, distance to rivers and roads, and short-range human movements. Among their findings, malaria incidence rates are higher in areas with closely clustered villages, says Dr Hernandez. Malaria also occurs more often in places where health facilities are scarce. "If people lack fast access to a diagnostic tool or treatment, they will become infective agents to the rest of the population," he explains.

Besides mapping malaria cases, the researchers examined the ecology of mosquitoes that carry the parasite in Oaxaca, and are now focusing on the role of community members in spreading the disease. "We are viewing humans as the real vector, with mosquitoes as the dispersing agent in the very local environment. But human beings are transporting the disease further away," stresses Dr Hernandez.

## Human ecology

"We don't know much about the ecology of human beings," admits [Mario Rodriguez](#), Director of the Institute's Centre for Research on Infectious Diseases. "So, with the help of community members, we are trying to understand the social and economic conditions of the people living there, and how they come in contact with mosquitoes. What are the activities that make them spread the disease around the area? We are also trying to find out why some homes harbour malaria — in some communities, certain households get malaria while neighbouring houses do not."

According to Dr Rodriguez, there are two mosquito species that transmit malaria in Mexico. In inland areas, the main mosquito vector produces cases primarily during the dry season, when local rivers empty and leave river pools, which are covered by algae that provide shelter for the mosquitoes. By removing this algae, the population of mosquito larvae decreases for almost two weeks, he notes. (A similar approach may also work in coastal areas, where malaria transmission, involving a different species, occurs in the rainy season. Although these mosquitoes do not breed on pond algae, there are some plants that provide habitat. If these plants are removed, the number of mosquitoes may decline — a theory that still needs to be tested.)

## Pond algae

So far, the algae removal strategy has been tried in several inland villages. Local women and men are removing the pond algae within a one kilometre radius of their villages — and with good results. The population of adult mosquitoes is decreasing in these villages, which means there is less need to spray insecticides.

The MCP Director, Dr Jorge Mendez-Galván, and Dr Rodriguez' team are also promoting a new approach to insecticide spraying. The traditional method used a hand pump to spray a film of DDT on the walls of homes to kill mosquitoes before or after they dined on human blood. Instead of DDT, people are now spraying their homes with alternative insecticides such as pyrethroids, which do not persist in the environment. Moreover, the researchers have developed a mechanical pump that sprays less insecticide but in larger droplets that remain on walls for up to six months — twice as long as before. Using this pump, two people can spray about 40 houses per day, compared to eight houses with the manual pump. "This means people are being protected faster, and at the same cost as the previous technology," Dr Rodriguez says.

## **Focal control**

Another innovation involves the focal or targeted control of malaria. Dr Rodriguez explains that patients who had malaria in previous years often relapse. "If you think that after you treat a community, it is free of the parasite, it's not true. It is dormant in the liver of the patients, and when the mosquitoes come back, the parasites wake up and malaria returns." The available data indicate that repeat cases represent around 50 % of all the malaria cases in Oaxaca.

"Instead of treating everyone and spraying all the houses in a community, the MCP approach now is to give chemoprophylactic — a malaria medicine — to those people who had malaria in the year or two before the current transmission season to stop them from having a malaria episode and, then, spray their homes. In this way, we think we can block the cycle of transmission and relapse," he says. "It's important that we don't give prophylaxis (preventative treatment) to everyone, mainly because of the cost but also because the malaria parasite will become increasingly drug resistant."

## **Rapid diagnosis**

Lastly, Dr Rodriguez and his colleagues are promoting a rapid diagnostic test "not as a means of finding malaria but as a means of controlling malaria," he stresses. According to Dr Hernandez, the traditional surveillance system is based on community participation: volunteer health workers take blood smears from people with malaria symptoms. The smears are sent to a hospital for analysis, a process which takes at least eight days but can be as long as six weeks. Meanwhile, patients are presumed to have malaria and given a "presumptive treatment," which improves their symptoms but does not rid them of the infective forms of the parasite. If the test proves positive, patients are given a full or radical treatment to rid their systems completely of the malaria parasite. The time delay between testing and treatment increases the risk that other community members will be infected.

With the rapid diagnostic test, "we are empowering the community to treat themselves," stresses Dr Hernandez. The test involves placing a drop of blood on a dipstick, which is put in a reagent mixture for 15-30 minutes. "If the test shows that you have malaria, the complete treatment can begin right away and hence the malaria transmission cycle can be broken."

## **Signs of success**

The research team is currently evaluating the rapid diagnostic approach in 20 different localities. But there are already signs the new control strategies are working. Since 1998, the number of malaria cases in Mexico has fallen sharply. There were just 2,000 cases last year, and only about 200 cases up to the end of May, 2001, reports Dr Rodriguez. "It's the first time in Mexico that an outbreak of malaria has been controlled without using DDT," he concludes.

*John Eberlee is the former Managing Editor of IDRC Reports Online. [Photo: Peter Bennett]*

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*If you have any comments about this article, please contact [info@idrc.ca](mailto:info@idrc.ca).*

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