

## What is vector control?

### History

At the end of the nineteenth century, researchers discovered that certain species of insect were responsible for the transmission of some serious diseases to humans. Since effective vaccines or drugs were not available for these diseases, the only means of prevention was to destroy these insects, also known as 'vectors', to prevent the diseases from spreading.



An Anopheles mosquito, vector of malaria

The discovery of DDT in 1940 was a major breakthrough in vector control. The insecticide was effective, cheap and remained active over a period of many months. Between the 1950s and the 1970s, household spraying of DDT made it possible to eliminate malaria (and other vector-borne diseases) from whole regions, or to bring them under very effective control. However, in Africa, where malaria is very widespread and its vectors numerous and active, its eradication proved impossible. At present, 90% of the world's fatal cases of malaria are in Africa.



Mosquito larva breeding site in urban outskirts

Eradication has not been possible, but wherever vector control has been practised, malaria has receded in spectacular fashion, including in the north and south of Africa.

## What is a vector, and how does it transmit disease?

Some insects, ticks and mites need blood in order to reproduce. When they bite a sick person, they ingest the parasites, viruses or bacteria present in the victim's blood.

In order to transmit the disease, the vector needs to live long enough for the parasite it has absorbed with the blood to complete its development cycle and to be passed on to another individual when it bites again.

## THE MAIN VECTORS AND THE DISEASES THEY TRANSMIT

Mosquitoes	Malaria, lymphatic filariasis, Japanese encephalitis, some haemorrhagic fevers (yellow fever, dengue, dengue haemorrhagic fever) and viral fevers (West Nile).
Tsetse flies	Sleeping sickness.
Triatomine bugs	Chagas disease.
Phlebotomine sandflies (small hairy flies)	Leishmaniasis.
Simulium (small black flies, that bite along riverbanks)	River blindness or onchocerciasis (filariasis).
Fleas	Plague, murine typhus.
Body lice	Typhus fever, louse-borne relapsing fever.
Ticks	Tick-borne relapsing fever, tick-borne rickettsial fever, Lyme disease.
Mites	Scrub typhus, scabies.

Intermediate hosts and possible vectors of disease:

Houseflies, cockroaches	Intestinal, skin and eye infections.
Gastropods (freshwater snails)	Schistosomiasis, liver-fluke disease.
Cyclops (crustaceans)	Guinea-worm disease.



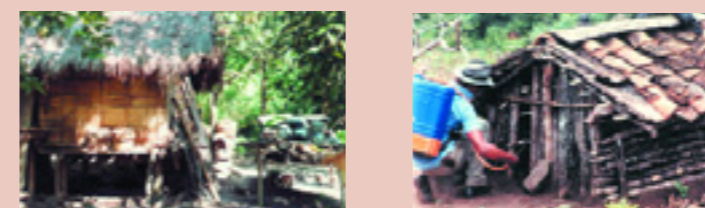
Puddles favour the proliferation of vectors

## What are the aims of vector control?

The purpose of vector control is to limit contact between humans and vectors, and to reduce vector populations or their life expectancy so that they are unable to transmit disease.

## VECTOR CONTROL TODAY

Vector control rarely relies on a single intervention. Whenever possible, environmental, biological and chemical (use of insecticides) control measures complement each other in what is known as **integrated vector management**.



In order to effectively control vectors, it is necessary to precisely identify them, to be familiar with their biology, their behaviour towards humans and their exact role in disease transmission. Only thus is it possible to undertake control measures and to intervene effectively.

## Why is vector control of importance for public health?

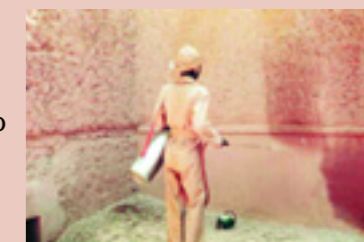
Vector-borne diseases cause death and disability. They are also an obstacle to social and economic development (lost working hours, abandonment of fertile land, high cost of treating disease).



A village in Burkina Faso which has been abandoned because of onchocerciasis

## What strategies are currently used in vector control?

Nowadays, we can call on tools and measures that are suited to vector control. Chagas disease control programmes in South America, and onchocerciasis control programmes in West Africa have demonstrated that wise use of insecticides and of existing methods of application produce excellent results at an affordable cost. However, this type of control measure requires trained staff and specialized control services, and both of these are unfortunately lacking in many of the most affected countries.



Household insecticide spraying

WHO favours vector-control measures which can be implemented by individuals and communities themselves in order to protect them against vector-borne diseases, provided that the measures have been proved to be efficacious. In most cases, the techniques are simple and cheap, and if properly used they present no danger either to the user or to the environment.

## VECTOR CONTROL TOOLS AND MEASURES

**1. Insecticides** play an essential role in vector control. Highly effective insecticides, of low or non-existent toxicity for humans, and which, being biodegradable, do not build up in the environment (e.g. pyrethroids) are now available.



Insecticide-treated mosquito nets prevent malaria



# Vector Control

They may be used, as appropriate, against adult insects or larvae, and in particular mosquito larvae, which live in water. Insecticides may be applied:

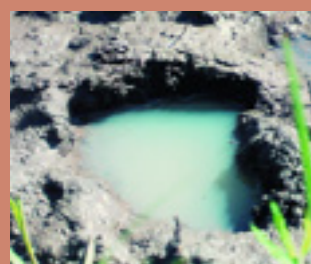
- by aerial, wall or domestic spraying;
- in water.

They need to be applied selectively, where they will have the greatest effect, which cannot be achieved by any other means.

**2. Personal protection** against bites can be achieved by applying repellents to the skin, by wearing appropriate protective clothing, if possible treated with repellents, or by use of insecticide dispensers and of mosquito nets and other material preferably treated with long-duration insecticides.

- Mosquito nets, when treated with certain insecticides, provide effective treatment against mosquito bites. In Africa, their systematic use in communities would make it possible to reduce cases of malaria by 50-60%, and infant mortality by 20-25%.

Treated mosquito nets which remain effective even after several washes are now available. These long-lasting nets will gradually replace the other types of treated nets. Increasing use is also made of treated textiles, particularly against household mites and ticks. Travellers to endemic zones and people subject to occupational exposure should systematically make use of treated nets and fabrics.



Animal footprints often provide breeding sites for the larvae of malaria vectors



Rice fields may favour the proliferation of malaria vectors

**3. Environmental measures** are intended to limit the proliferation of vectors by modifying or destroying their breeding sites through simple measures. One good example is the elimination of stagnant polluted water in urban settings. However, such measures first require a careful study of the vectors, and must be well suited to local conditions.

**4. Biological control** relies on the use of living organisms, or of products derived from them, to destroy the vectors. Depending on the circumstances, these may be parasites, bacteria, or predators (mosquitos, crustaceans or fish).

## What are the obstacles to vector control?

In the most affected countries, the absence of control services with trained staff and proper logistic support is a major obstacle to vector control.

Numerous vectors are developing resistance to insecticides. This complicates control, because of the need to come up with substitute products, which is a challenging task. As far as possible, an effort is made to prevent the development of resistance by avoiding inappropriate use of insecticides.



An insecticide-impregnated tsetse fly trap

## Further information from:

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## PROGRESS MADE SO FAR

Over the past decade, the measures described above have been widely used in vector control. Modern techniques, such as long-lasting insecticide treatment of textile fibres, real-time use of satellite images and of geographical information systems allow control measures to be better organized and targeted.

It is now possible in the laboratory to produce genetically-modified vectors which have lost their capacity to transmit disease. However, their use in the field raises numerous issues which have not yet been resolved.

## FLASH TIPS

*Did you know that...*

*...onchocerciasis control in West Africa has largely relied on a natural bacterium, *Bacillus thuringiensis israelensis*; when spread in rivers, it destroys the vector's larvae without affecting the other aquatic organisms or natural equilibria?*

*...Chagas disease has been brought under control in several South American countries thanks to a single household spraying of insecticide?*

*...for some diseases such as malaria or certain haemorrhagic fevers, a single bite from an infected mosquito may suffice to cause death? Protect yourself, and above all do so systematically.*

*...mosquitos and other vectors have never been shown to transmit HIV?*

*...insecticide resistance is an evolving phenomenon? It is passed on from one generation to the next.*

*...malaria mosquito vectors frequently travel in aircraft and may transmit the disease during flight or at the arrival airport, if the aircraft is not properly disinfected?*

*...malaria was rife throughout Europe until the beginning of the twentieth century, including in northern countries such as Finland and Norway?*

