VECTOR CONTROL

An attainable goal

Development has ironically invited the resurgence of many a vector-borne disease. Finding new drugs is not the panacea. P. K. Das and P. Jambulingam make the case for eco-friendly integrated vector management.

VECTOR-BORNE diseases are caused by a variety of parasites which are transmitted by a living carrier. A majority of the vectors are arthropods.

The important vector-borne diseases prevalent in India are malaria, filariasis and arboviral diseases such as Japanese encephalitis, dengue, chikungunya and dengue haemorrhagic fever (spread by mosquitoes), leishmaniasis, dermal & visceral (sandflies), plague (fleas) and Kyasanur forest disease (ticks).

Statistics indicate that more than five million children die of vector-borne disease annually throughout the world. Fragmented data makes it impossible to estimate the prevalence of vector-borne diseases in India. While the prevalance of malaria and filariasis can be estimated to a certain extent, data on other vector-borne diseases is negligible. One thing is certain though, we are losing the battle against most vector-borne diseases. Worse, some of these diseases are re-emerging as major problems – the frequent outbreaks of arboviral diseases like Japanese encephalitis, dengue and plague, to cite an example.

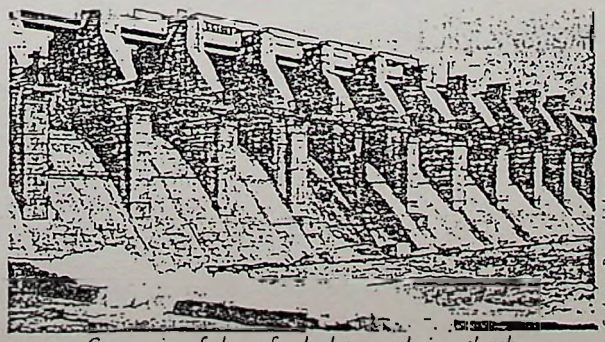
The outbreak of vector-borne diseases is determined by the complex interaction of three agents, namely parasite, host and vector in a particular environment (physical, socio-economical and cultural). The increase or decrease of vector-borne diseases cannot be attributed to the success or failure of the control programmes alone.

Population growth

Ecological changes associated with population growth and development are often responsible for any outbreak of vector-borne diseases. The growth in population facilitates host-parasite vector interaction by bringing the two together.

Development activities could broadly be classified into two groups. One group of activities is meant for increasing primary production, namely, agricultural activities, including irrigation projects, construction of dams and sinking of borewells. These lead to deforestation, waterlogging, climatic changes, etc. The second group of activities is related to secondary production, which includes industrialisation and consequent urbanisation that triggers large-scale migration.

These activities facilitate the movement of parasite carriers or non-immune people, creating a new foci or an epidemic of vector-borne diseases.



Suhana Parrenbith

Construction of dams often leads to a malaria outbreak.

Development projects are initiated to provide basic amenities in human settlements. In the process, extensive ecological changes are wrought that are conducive for not only vector-borne diseases but for many other new diseases.

Let us examine how we can tackle the problems of shelter, water, air and food and their impact on the proliferation of mosquito-borne diseases.

Shelter: The world is inhabited by 5.7 billion people with 90 million being added every year. We keep converting fertile agricultural land into housing plots to accommodate an increasing population. When horizontal expansion is not possible we construct multi-storied buildings. This way, we induce permanent changes in an area by replacing the natural ecosystem with a man-made one. One consequence of such development is the multiplication or expansion of mosquito breeding habitats.

Haven for vectors

Multi-storied buildings are a haven for mosquitoes. Overhead water tanks, ornamental tanks and cisterns help in the breeding of the malaria vector *A stephensi* while modern home-appliances like air-conditioners, coolers and heaters, etc., provide an ideal condition for the breeding of the aedes mosquito, which transmits dengue and yellow fever.

Construction in urban areas lead to large-scale migration of labourers from different parts of the country and aggregation of non-immune people and parasite carriers. When there is irregular water supply, people store water in a variety of containers. This also facilitates the breeding of the aedes mosquito, increasing the risk of an outbreak of dengue.

Water: Water is essential for our survival; the demand for it is growing with the increase in population. The technology for extracting groundwater is so advanced that we neglect to harness surface water. We continue to exploit groundwater resources despite realising that it is not unlimited.

Inadequate solid waste and waste water management are often major causes for the proliferation of vectors, especially the filariasis vector *Culex quinquefasciatus*, houseflies, cockroaches and rodents. Diseases like filariasis occur due to poor waste water management, while malaria and dengue are the result of improper water storage methods.

Stagnant water: Ideal breeding ground for mosquitoes.

Food: Various technologies have been introduced in agriculture and animal husbandry to ensure food security. Irrigation projects can either increase the malariogenic potential in an area by introducing an increasing vector population or sometimes reduce the potential by replacing an efficient vector with an inefficient vector. However, the problem in water development projects is more acute at the time of construction when migration of non-immune people creates an epidemic situation – for example, intense transmission of Falciparum was recorded at the time of the construction of the Nagarjuna Sagar dam in Andhra Pradesh, the Indravati Project in Orissa, the Upper Krishna project in Karnataka and the Indira Gandhi Canal in Rajasthan.

Modern agricultural practices depend on prophylactic use of pesticides. This has eliminated many useful insects and the hymenopteran parasites that helped in regulating vector population. For example, coelomonyces, a fungal infection in mosquitoes was quite common but with the extensive use of insecticide, the infection rate drastically reduced due to a decline in cyclops and other ostracod population (intermediate host). It also precipitated resistance in the vector population.

Fallout of deforestation

Deforestation, which is a common factor in any development activity, causes an imbalance in the man:animal ratio, diverting the mosquito vectors which otherwise feed on animals to humans. The incidence of malaria is high in the border districts of Andhra Pradesh and Orissa and in north-eastern States where labour camps are organised for cutting bamboo for the paper industry. In time, the forest-dwelling species disappear with the forest and are replaced either by *C. quinquefaciatus* which breed in man-made breeding habitats or by other anopheline species like *A. culicifacies* breeding in wet lands. By destroying forests man encroaches on the natural ecosystem and renders himself susceptible to many zoonotic diseases, which in due course of time may become anthroponotic. The Kyasanur forest disease is a good example of this.

Until 1940, programmes to control vector-borne diseases were based on improving sanitation and personal protection measures. A few examples are the yellow fever control programme in the Panama canal and the malaria control programmes in Malaysia and Peshawar, etc. However, these control methods were considered too expensive for large-scale programmes. The control programmes at that time were meant only for a selected percentage of the population. With the introduction of DDT, all the measures based on sanitation were completely neglected.

Here, we would like to emphasise that developed countries in the West controlled many of these diseases mainly by resorting to simple sanitary measures. They did not wait for any new vaccine, drugs or molecular tools to control these diseases.

The prevalence of vector-borne disease in an area depends upon the host-parasite vector interaction in that area. It is therefore a local problem and varies even within the city. Following a uniform strategy for the entire city is neither cost-effective nor necessary. However, planners stick to a single and uniform strategy in the name of simplicity, overlooking the fact that if control measures are initiated according to the local problem, one can not only save money but implement it more efficiently.

In the Sixties, insecticide was the panacea and now the bio-environmental control of vectors and anti-parasitic drugs have the same status. Instead of controlling the vectors, drugs are distributed for controlling diseases like malaria and filariasis. Suddenly, insecticide has become bad and the use of drugs good.

We do not intend to advocate the importance of insecticides alone. In fact, we are against depending on any particular tool for all types of situations. Neither vector control nor parasite control in isolation can produce the desired results. While there are many tools for a particular situation, there is no tool which can be effective for all situations.

Advertisements like "Fever? It may be malaria, take chloroquine" mislead people into believing that a few tablets of the drug will cure malaria.

Bottlenecks

The present strategy also suffers from some operational and administrative bottlenecks like inadequate funding, lack of quality control of insecticides, absence of flexibility in decision-making, lack of motivation for vector-control staff, unwillingness to introduce new concepts, etc.

Inspite of these problems, the control programmes in our country did achieve considerable results in the past. After the introduction of DDT residual spray under the National Malaria Eradication Programme (NMEP), the incidence of malaria declined from an estimated 75 million cases with 0.8 million deaths in 1952 to an all-time low of 0.1 million case with no casualties. Diseases like leishmaniasis, dengue, etc., were brought under control. A four-fold increase in the population testified to the success of various technological developments in bringing down mortality from vector-borne diseases. If the efforts were successful why are we then

witnessing the emergence or re-emergence of vector-borne diseases? Is it that the tools available are not adequate to tackle the problem or is it the lack of application of these tools?

The risk of an outbreak of disease has increased over the years. We are content with fire-fighting measures to tackle these diseases. What is required is a comprehensive plan and concentrated efforts based on a continuous monitoring of the situation. The tools available are still sufficient to keep the diseases under control. Since environmental degradation is the major cause for the increase of vector-borne diseases, must we not attempt to improve environmental conditions?

Improper waste disposal also causes vector-borne diseases.

The strategy for controlling vectors varies from species to species. Even for the same species, the method of control may vary from one area to another. Therefore, the approach to vector control must change from an overuse of pesticides to an eco-friendly integrated vector management (IVM).

IVM is essentially an ecological information-based control programme that utilises artificial or natural control tools to be fitted as unobtrusively as possible into the total environment to effect the suppression of pest species at the time and place where they escape the repressive effect of natural control.

Community must participate

Information about the vectors – where they live, when they feed, where they breed, etc. – is important for any strategy to control them. Gathering information on ecology and epidemiology during a lean period is considered unnecessary expenditure. However, public health authorities must be vigilant and try to destroy the vectors during the lean period itself. This is easier said than done as maintaining a huge infrastructure for surveillance may be beyond many disease control agencies. Since we are dealing with a dynamic system which changes rapidly due to human interference, surveillance should be an integral part of the strategy and carried out independently. Since there is no substitute for surveillance, one cannot dispense with it. However, the cost of surveillance can be minimised by either utilising existing infrastructure or seeking the help of NGOs.

Community involvement must be ensured from the planning stage itself and education should form an integral part of the strategy. Educating people with half-truths may boomerang. The advertisement in inland letters says "Fever? It may be malaria take chloroquine." Such advertisements make people believe that a few tablets of chloroquine will cure malaria. The message could instead read "Fever? It can be malaria and may be fatal if not treated. Take treatment under the supervision of a physician."

Vector control can be achieved either by killing or regulating the population of the vectors. Our experience has shown that using chemicals to kill insects with a high reproductive potential is a cumbersome process requiring repeated applications which are operationally and economically not feasible in the long run. Secondly, the resurgence of the vector population due to the elimination of biocenotic regulators by toxic chemicals leads to population stabilisation at a higher level.

A majority of our programmes suffer due to poor implementation. Implementing agencies need to be identified at the design stage. It is not possible for vector control agencies alone to tackle the problem. The major responsibility for improving the environment must lie with the people. This needs to be enforced by a strict Public Health Act. Punishment should be so severe as to thwart any repetition.

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