Health Impact Assessment (HIA) of Development Projects with Reference to Mosquito-borne Diseases

It is recognized that the very development that intends to improve the quality of life of the people, if not managed properly, often leads to conditions hazardous to health of the people and their environment. Poor environmental conditions are the cause of most water-borne, air-borne and vector-borne diseases and contribute to poor health and a poor quality of life. Economically poor communities, children, women, most people in least developed or developing countries and the migrant work force generally constitute the most vulnerable groups. Rio de Janeiro Earth Summit in 1992 stressed that development was about meeting the needs of people, their health, well-being and lives, and a safe environment.

Broadly the health impact assessment is a change in health risk reasonably attributable to a project, programme or policy where a health risk is the likelihood of health hazard affecting a particular community at a particular time. Health impact assessment can make health benefits more explicit in non-health areas, can look at the unintended health impacts of non-health policies which would not otherwise be explicit and help in either incorporating health safeguards in the project cycle or taking mitigating measures. Whereas positive impacts of development improve overall well-being, the types of health hazard associated with a development project are broadly classified as communicable diseases, noncommunicable diseases, nutrition, injuries and psychosomatic disorders.

The problem of vector-borne diseases associated with water resource projects has received a considerable attention for many years. During the pre-DDT era, most major projects in India were being prospectively assessed for adverse health impacts. By providing proper subsoil drainage, the Sarda Canal Barrage in U.P. did not create malariogenic conditions. Other noteworthy examples of assessment of impact on malaria of the water resources development projects include Upper Krishna Irrigation Project, Irwin Canal (Karnataka), Thermal Power Plant in Delhi and Vizag Steel Plant.

HIA Studies undertaken by MRC

Sardar Sarovar Water Resources Development Project (Gujarat)

The Sardar Sarovar is a multipurpose water resources development project created on river Narmada in the Gujarat state (Fig. 25). It will generate electricity, provide irrigation and drinking water to nearly 110 cities and towns in the semi-arid areas of Gujarat and Rajasthan states in western India. Construction of dam started in 1979 and picked up momentum in 1986. Several residential colonies for engineers,

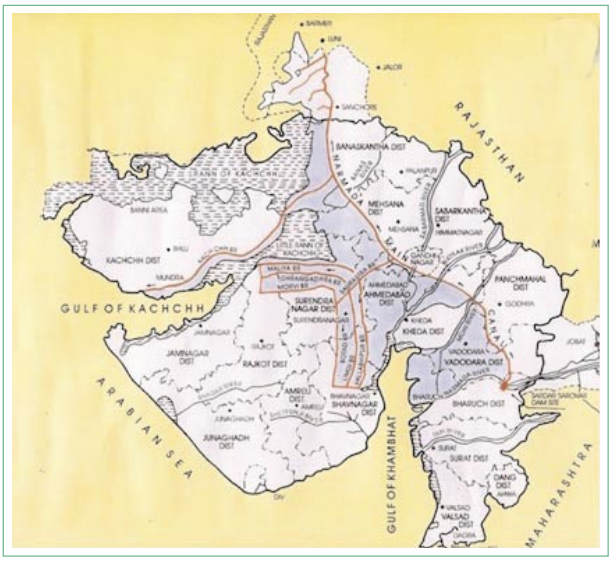

Fig. 25: **Command area of the Sardar Sarovar Project in Gujarat**

workers, labourers and other supporting communities came up in the close vicinity of the dam.

An unusual increase in malaria was recorded at the project site following commencement of the construction of the dam (Fig. 26). An epidemiological investigation undertaken by MRC during 1994–98 showed that *An. culicifacies* and *An. fluviatilis* were present in the colonies at the project site and in the surrounding villages. *An. culicifacies* was the predominant species. Although the dam has been built in the valley area, creation of dyke ponds and interruption of downstream flow of water caused potential breeding habitats of vector species resulting in a built up of high vector densities. The incidence and prevalence rates of malaria were far greater in the population at the project site as compared with those in the surrounding villages (Fig. 27). The increased transmission of malaria at the project site was attributed to factors such as the congregation of migrant work force from the malaria endemic areas of the country in close proximity of the mosquito breeding habitats created by the project. In future, it would be essential to screen all immigrant labourers for malaria and treat them properly to prevent built up of parasite load in the project site communities.

The impact on malaria and other vector-borne diseases of irrigation in the command area and resettlement of displaced people is being assessed as part of a 5-year project now under implementation in Phase I districts in generic manner. The objectives of the study in Phase I command area include assessment of the community vulnerability, environmental receptivity and preparedness of the health services with reference to malaria and other communicable diseases such as filariasis, Japanese encephalitis, dengue and leishmaniasis (kala-azar).

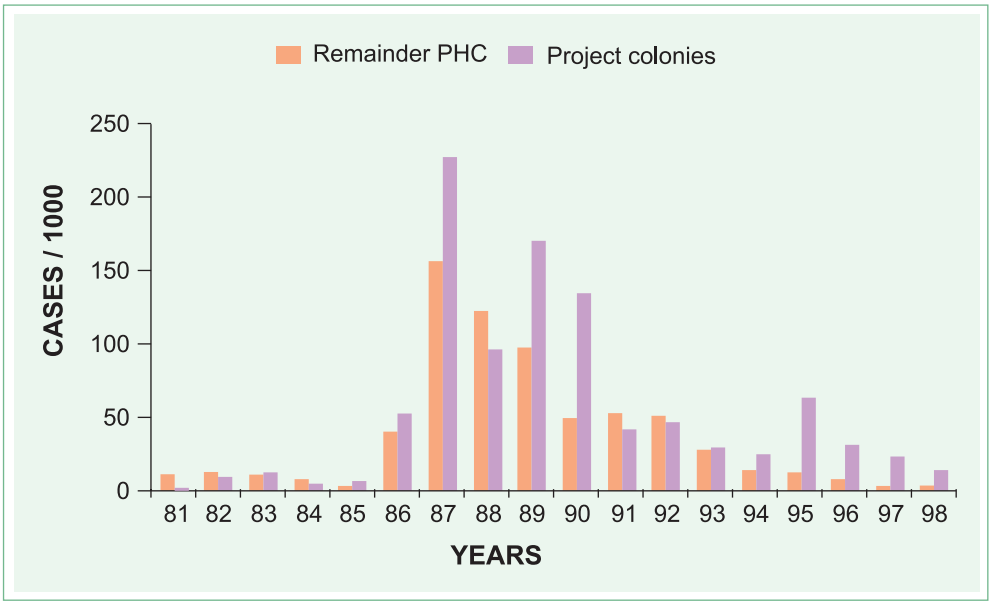

Fig. 26: **Secular trend of malaria in project colonies and the surrounding PHC villages (Sardar Sarovar Dam)**

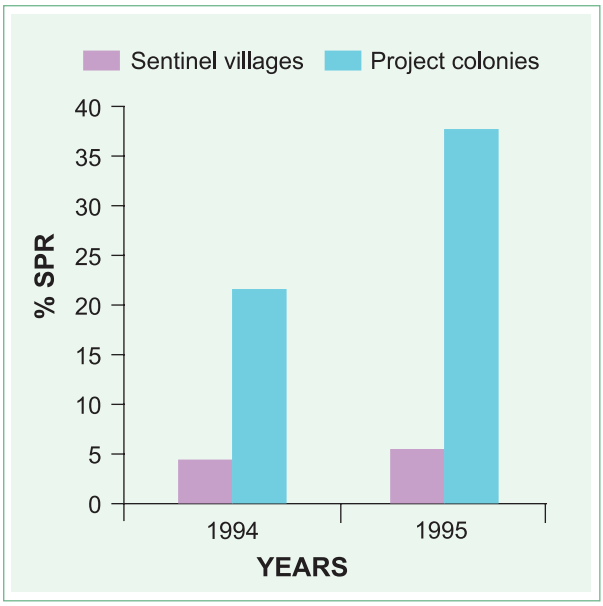

Fig. 27: **Malaria incidence in the project colonies and the surrounding village (Sardar Sarovar Dam)**

Bargi Dam Project (Madhya Pradesh)

Bargi Dam has also been created on the River Narmada in Madhya Pradesh during 1974–88. Building of the dam has resulted in the submergence of 162 villages in Jabalpur, Mandla and Seoni districts. A study by MRC on the impact of the project on malaria following the report of deaths in some submerged villages of District Mandla (Singh *et al.*, 1997) showed that the villages had high incidence of malaria, gametocyte carriers (13%) and splenomegaly among the children. Submergence caused an increase in the malaria incidence and *P. falciparum* cases several fold. There is substantial evidence to indicate that *Pf* has invaded almost the whole region and caused immense misery, including many deaths.

Among the malaria vectors—*An. culicifacies* and *An. fluviatilis*, the former was resistant to DDT and HCH. In a newly irrigated area in District Jabalpur, *An. annularis* was the predominant species in the head-end villages and its abundance was directly related to the opening of the canal, whereas *An. culicifacies* was the most abundant species in tail-end villages with scanty irrigation. Malaria infection was due to *P. vivax* and *P. falciparum*. The annual parasite incidence in children and adults was 4 fold higher in head-end villages as compared to that in tail-end villages.

Some of the risk factors identified are: widely distributed clusters of hamlets, increasing operational difficulties in disease surveillance, continuance of the people in some submerged villages, increased groundwater level, fishermen's preference to live close to the reservoir (Fig. 28), migrant fishermen and lack of commensurate increase in medical care and insecticide spraying. Effective prevention and control of malaria in affected villages should include improved disease surveillance, use of effective antimalarial drugs, use of rapid diagnostic kits in epidemic situations, health education, use of effective insecticides, promotion of the use of insecticide impregnated nets. Displaced people should be resettled in healthy areas. Poor engineering design is difficult to correct after construction, and hence early planning is critical. It is already too late for Bargi Dam to prevent some of these consequences. Construction is progressing and action is required now to develop an effective health care programme based on local transmission involving multisectoral action and community participation to prevent the spread of disease in the whole region.

Konkan Railway Project

Konkan Railway line has been laid connecting Roha to Mangalore. This railway project became operational in December 1998. The rail line passes through hills and valleys of West Coast belt of Maharashtra, Goa and Karnataka states. This project is an engineering marvel as it traverses through one of the most rugged and difficult terrain. The Konkan region is high rainfall zone and numerous natural watercourses facilitate the watershed from hills to the Arabian sea. When the constrcution of this major railway project commenced, it was feared that the fragile ecology of Konkan region could be adversely affected due to obstructions caused to the natural drainage system. To overcome this problem, 180 major bridges totaling a length of 21 km and over 1600 minor bridges were constructed over rivers, rivulets and backwaters so that natural drainage system should not be obstructed.

Fig. 28: **Photograph showing hutment in Bargi Dam area**

Besides, 92 tunnels measuring a total length of 84 km were also constructed through rocky as well as soft soil hills.

It was feared that the construction would adversely affect the fragile ecology and enhance the malariogenic potential in the Konkan region. It was suspected that there would be large-scale immigration of people, particularly construction labour, from other parts of India to this region. This could lead to the creation of slums and thereby formation of disease reservoir, which could trigger epidemics of the diseases particularly that of mosquito-borne diseases, the foremost being malaria. The state of Goa was already reeling under a severe outbreak of malaria and annual monsoon associated outbreaks of JE in the towns and villages along the coast, not very far away from the line under construction.

MRC field station, Goa conducted a study to assess the impact of the project on mosquito-borne diseases in association with Konkan Railway authorities. By geographical reconnaissance of the project in the Goa sector, mosquitogenic and malariogenic potential of the project was assessed. With the cooperation of Medical Officers of the Directorate of Health Services, Goa, the entire labour population was screened for malaria and treatment to malaria patients was provided to prevent further outbreaks.

On the basis of this survey, MRC recommended a number of measures, which have been implemented

Masonary tank being filled

Tank being leveled with earth

Drains on sides of track

Sleeper curing tank being used as fish hatcheries

by the railway authorities to reduce mosquitogenic and malariogenic potential. The collaboration between Konkan Railways and Malaria Research Centre is a unique example of inter-sectoral collaboration, which is truly a landmark in the prevention of mosquito-borne diseases. In the words of the Chairman and Managing Director of Konkan Railways, "There has not been a single outbreak of any mosquito-borne disease since the inception of Konkan Railway project which is a tribute to the hard work of MRC and the Engineers of Konkan Railway and with a little additional cost, outbreak of mosquito-borne diseases could be successfully averted". MRC is now preparing a monograph based on this exercise for use in similar projects in future.

In conclusion, development of resources is necessary and the projects are intended to improve the quality of life. All developmental activities must look at the associated health issues and ensure that appropriate and durable safeguards are in place. The adverse effects of the development projects should not be passed on as hidden costs to a health sector that is already constrained by inadequate financial resources to mitigate human suffering. India is a signatory to the 1992 Rio Earth Summit which stated that development was about meeting the needs of people, their health, well-being and lives, and a safe environment. The Rio+10 review has taken place in August 2002 and it is time that we look at the health impact of development projects for sustainable development. n