

Epidemiology

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Malaria Epidemic Investigations

A number of malaria outbreaks have occurred in the country. The Institute carried out investigations of epidemics either at the request of National Anti Malaria Programme (NAMP), State Government, Indian Council of Medical Research (ICMR) and/or on its own to find out the causes/factors responsible for the epidemic.

During 1981–82, investigations were carried out in Kharkhoda PHC of Sonapat district (Haryana) and

Kichha PHC of Nainital district, Uttarakhand (erstwhile Uttar Pradesh) to assess the malaria incidence (Sharma *et al* 1983). In Gadarpur PHC of Nainital, resurgence of malaria was investigated in 1983 and slide positivity rate (SPR) was found to be 67.5 and slide falciparum rate (SFR) 71.5%. *Anopheles culicifacies* and *An. fluviatilis* mosquitoes were incriminated as vectors of malaria (Chaudhary *et al* 1983). In villages of Nigohi and Tilhar PHCs of

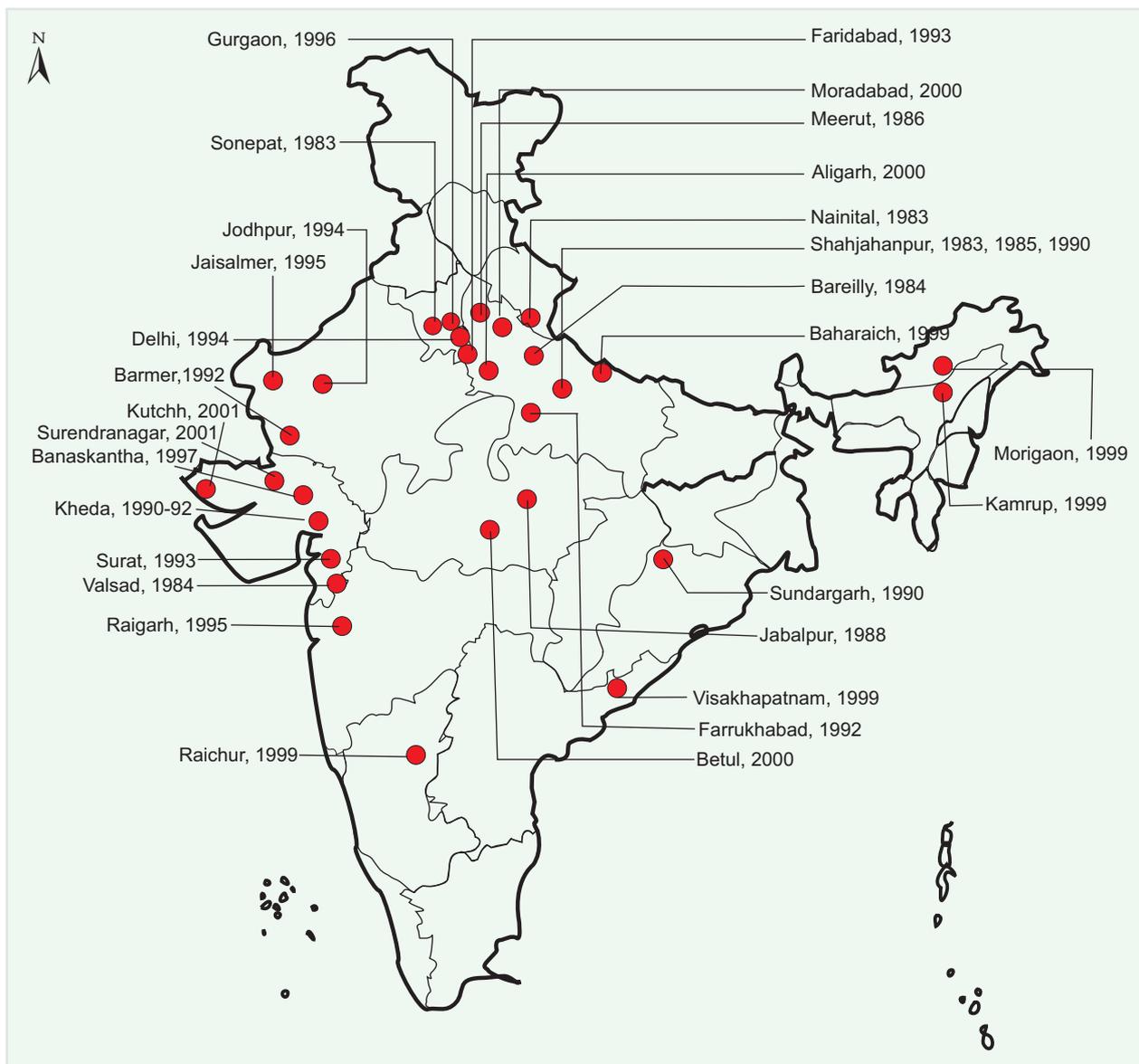


Fig. 1: Malaria epidemic investigations carried out by the National Institute of Malaria Research from 1981–2001

Table 1. Malaria epidemic investigations carried out during 1999–2001

Place and month of investigation	Findings *Recommendations
Morigaon, Golaghat (Kamrup, Assam) May 1999	Lack of surveillance. *Use of ITN and IEC activities suggested.
Paderu (Visakhapatnam, A.P.) July 1999	Lack of surveillance owing to difficult terrain, onset of early rains, detection of resistance in <i>An. culicifacies</i> to DDT, detection of resistance to chloroquine in <i>P. falciparum</i> . *Use of malathion/synthetic pyrethroids for residual spray, treatment schedule for drug resistant subjects as per NAMP policy and to explore the possibility of using ITN.
Jarwal (Baharaich, U.P.) Sep–Oct 1999	Shifting of surveillance workers resulted in low API (<2) hence, there was no spray and resistance in <i>P. falciparum</i> parasite to chloroquine. *Training of technicians, use of suitable drug for resistant cases as per NAMP policy and strengthening of surveillance also in other PHCs of the district.
Raichur (Karnataka) Nov 1999	High SPR 71.2% with <i>Pf</i> 95.1%, <i>An. culicifacies</i> resistant to DDT, <i>P. falciparum</i> parasite resistant to chloroquine. *Bio-environmental control through larvivorous fishes.
Moradabad (U.P.) (Sep–Oct 2000)	SPR 84.7; <i>Pf</i> 97%; <i>An. culicifacies</i> was resistant to DDT and susceptible to malathion and deltamethrin. *Deployment of health workers and strengthening of surveillance system were recommended.
Dadri CHC, Gautam Budhnagar (U.P.) Sep 2000	Mean SPR 44.6% (highest 52.1%); <i>Pf</i> 87.6%. <i>An. culicifacies</i> was found resistant to DDT (21.5% mortality). Insecticide spray was not done for last 10 years. *Strengthening of surveillance system, change of insecticide for IRS
Betul (Chhattisgarh) Oct–Dec 2000	35 affected villages of three PHCs were surveyed, SPR, SFR and <i>Pf</i> were 52.5, 50 and 93.3% respectively. *Synthetic pyrethroid/malathion to be sprayed in all the PHCs. Mobile health clinic/camp to be organised on a priority basis. All <i>P. falciparum</i> cases are to be treated with Fansidar (SP combination). People to be encouraged to use personal protective measures, i.e. bednets, skin repellents etc. In remote villages rapid diagnostic tests, such as OptiMAL/ICT are to be used. Pregnant women and infants are to be given chemoprophylaxis, and health education on top priority, and release of larvivorous fish in all breeding places. These recommendations were implemented by Govt. of Madhya Pradesh as a result there was over 60 and 70% reduction in malaria cases and in falciparum cases respectively in 2002. Besides, spleen rate in children declined from 72% in 2000 to 25% in 2002.
Chandausi and Iglas PHCs, Aligarh (U.P.) Nov 2000	SPR 41–73.6%; <i>Pf</i> % 94.7–100; and IRS was not done for last 10 years. *Strengthening of surveillance and IRS to be done regularly.
Surendranagar (Gujarat) 2001	Some villages were affected by the earthquake, poor surveillance, high rainfall leading to high densities of <i>An. culicifacies</i> , poor coverage of malathion spraying in some villages, high breeding of anophelines in domestic waters, susceptibility of <i>An. culicifacies</i> to malathion was 100%. Mopping up round of malathion sprayed in villages with poor spray coverage. *Since it is dry zone, use of fish in permanent waters and peridomestic breeding can be controlled in most months of the year, improvement in EDPT, training of PHC Medical Officers, detailed epidemiological study in Patadi taluka.
Kutchh (Gujarat) 2001	Increased vulnerability after earthquake due to breakdown of health services, excess rainfall, migrant labourers for reconstruction brought parasite load. *Strengthening of active and passive surveillance including role of mobile dispensaries, fogging in outbreak-affected villages, use of fish in permanent water bodies and check dams, use of rapid diagnostic kits, training of MO's, laboratory technicians, screening of labour population.

*The recommendations/suggestions were sent to the concerned state government and NAMP for necessary action.

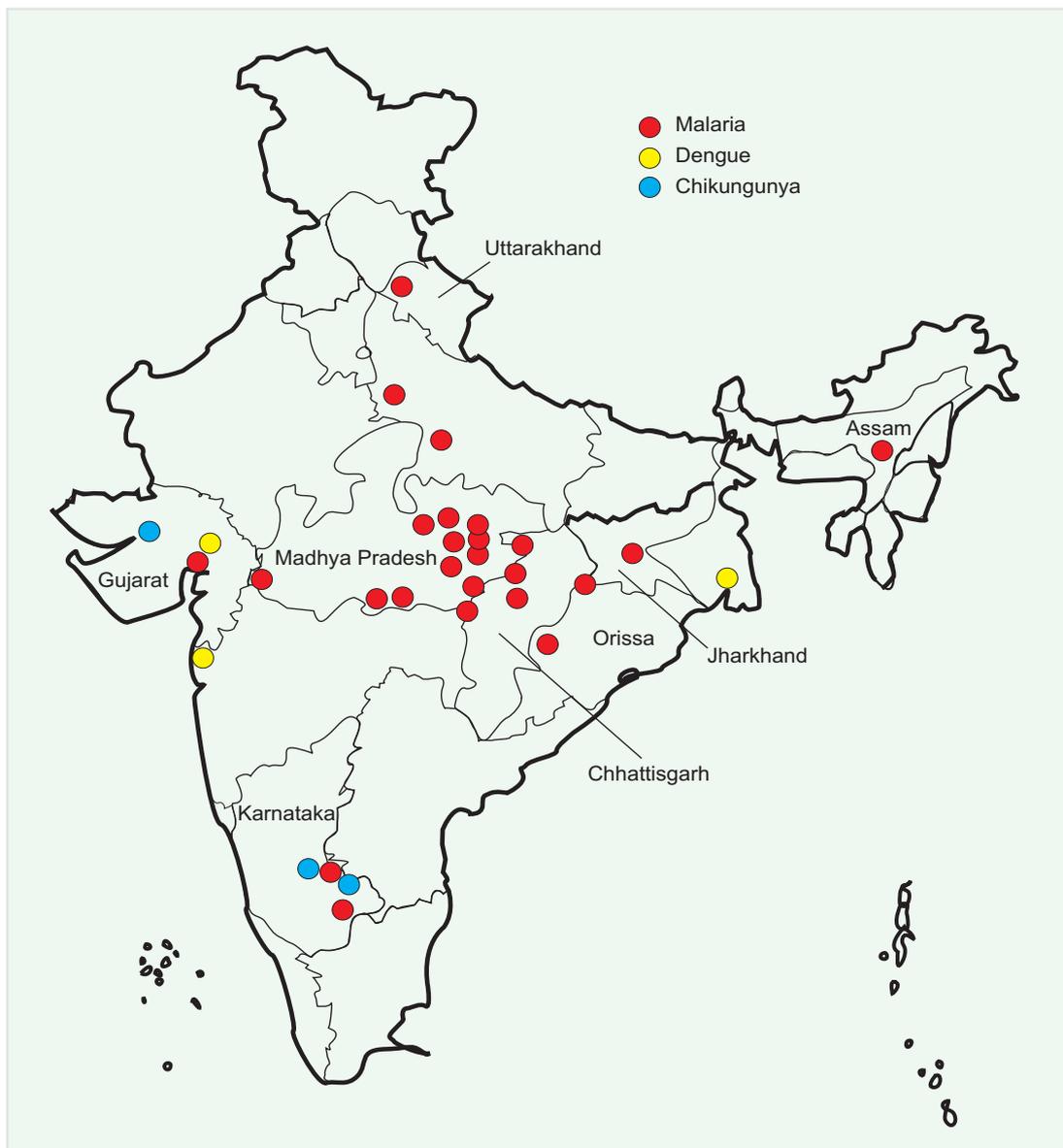


Fig. 2: Outbreaks of vector diseases investigated by NIMR from 2002–06

Shahjahanpur district, Uttar Pradesh (Chandrahas and Sharma 1983), in spite of three rounds of HCH spray and intensive efforts to control malaria, SPR was 75.3 and SFR was 95.1%. HCH was not effective against malaria vectors due to development of resistance. Remedial measures were suggested to the state government. Follow-up studies as well as subsequent epidemics of malaria in Banda PHC (Shahjahanpur) and Banyani PHC of Farrukhabad and Bareilly (Uttar Pradesh) were also investigated (Ansari *et al* 1984; Sharma *et al* 1985; Prasad *et al* 1992; Prasad and Sharma 1990). In 1986, in villages of Meerut district (Uttar Pradesh), it was found that about half of the patients were asymptomatic and HCH was found ineffective (Ansari *et al* 1986), and malathion for indoor residual spray (IRS) was recommended. Investigations were carried out in Madhya Pradesh (Singh *et al* 1988), Gujarat (Sharma and Gautam 1990; Srivastava *et al* 1995; Srivastava and Yadav 2000), Haryana (Sharma 1993;

Raghavendra *et al* 1997), Rajasthan (Shukla *et al* 1995; Batra *et al* 1999) and Delhi (Adak *et al* 1994; Sharma *et al* 1985). The locations of all study sites with years of investigations are shown in Fig. 1. Details of latest epidemic investigations carried out during 1999 to 2001 in Visakhapatnam (Andhra Pradesh) (Dhiman *et al* 2001), Baharaich (Uttar Pradesh) (Dhiman *et al* 2001), Morigaon and Golaghat (Assam), Raichur (Karnataka), Dadri, Aligarh and Moradabad (Uttar Pradesh), Betul (Chhattisgarh), Surendranagar and Kutchch (Gujarat) are given in Table 1.

On the request of NVBDCP or state governments, NIMR investigated the outbreaks of malaria, dengue and chikungunya in different parts of the country from 2002–06 (Fig. 2). Most of the outbreaks were confined to Madhya Pradesh, Karnataka, Gujarat and Assam. The findings/recommendations were sent to concerned state governments for remedial measures.

During 2000, an outbreak investigation under-

taken in Betul (Madhya Pradesh) and the follow-up of recommendations of NIMR became a success story for control of epidemic malaria.

Betul, a success story of malaria control using existing tools

Betul, a tribal forested district is highly malarious. An outbreak of malaria was recorded in Betul district, during October 2000, which caused very high morbidity and mortality. NIMR surveyed 40 villages in 3 PHCs on the request of Govt. of Madhya Pradesh. In view of the very high prevalence of falciparum malaria, intensive intervention measures were recommended by NIMR that DDT should be replaced by an effective insecticide (synthetic pyrethroid), prompt treatment of all fever cases with SP, release of larvivorous fishes in breeding sites, use of rapid test in remote areas for on the spot diagnosis and treatment and regular

information, education and communication (IEC). These recommendations were implemented by the state government and post-intervention showed a sharp steady decline in number of malaria cases. There were 28, 32, 51, 52 and 52% reduction in SPR and 33, 40, 49, 49 and 48% reduction in SFR in 2001, 2002, 2003, 2004 and 2005 respectively. Spleen rate also showed decline, i.e. 5, 47, 60, 66 and 68% reduction in 2001, 2002, 2003, 2004 and 2005 respectively as compared to 2000. Monitoring of entomological results revealed a significant decline in both *Anopheles* and *An. culicifacies* ($p < 0.00001$). A combination of indoor residual spraying and early detection and prompt treatment complemented by rapid diagnostic tests and larvivorous fishes successfully brought malaria under control. These approaches could be applied in other regions of different endemicity to control malaria in India.

