TRAINING MODULE
FOR
MALARIA TECHNICAL SUPERVISOR

Directorate of National Vector Borne Diseases Control Programme
Directorate General of Health Services,
Ministry of Health and Family Welfare.
Learning Unit 1. Health System in India

1.1 Rural Health Care System

The health care infrastructure in rural areas has been developed as a three-tier system, i.e., Sub-centre, Primary Health Centre and Community Health Centre.

1.1.1 Sub-Centre

The Sub-Centre is the most peripheral and first contact point between the primary health care system and the community. Each sub-centre is staffed by one Multipurpose Health Worker – Female (MPHW-F)/ Auxiliary Nurse Midwife (ANM) and one Multipurpose Health Worker - Male (MPHW-M).

1.1.2 Primary Health Centre (PHC)

The PHC is the first contact point between village community and the Medical Officer. The PHCs provide integrated curative and preventive health care to the rural population with emphasis on preventive and promotive aspects of health care. The PHC is staffed by a Medical Officer supported by 14 paramedical and other staff. The staff are as follows:

<table>
<thead>
<tr>
<th>Ser No</th>
<th>Staff</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Medical Officer</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Pharmacist</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Nurse Mid-wife (Staff Nurse)</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Health Worker (Female)/ANM</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Health educator</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Health Assistant (Male)</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Health Assistant (Female)/LHV</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Upper Division Clerk</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>Lower Division Clerk</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>Laboratory Technician</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>Driver</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>Class IV</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

1.1.3 Community Health Centre (CHC)

The CHC serves as a referral centre for 4 PHCs and also provides facilities for obstetric care and specialist consultations. It has 30 beds, one operation theatre, X-ray, Labour room and laboratory facilities. The staffing is as follows:
<table>
<thead>
<tr>
<th>Ser No</th>
<th>Staff</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Medical Officer*</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>Nurse Mid-wife (Staff Nurse)</td>
<td>7</td>
</tr>
<tr>
<td>3.</td>
<td>Dresser</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Pharmacist/Compounder</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Lab Technician</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Radiographer</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Ward boys</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Dhobi</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>Sweepers</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Mali</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>Chowkidar</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>Aya</td>
<td>1</td>
</tr>
<tr>
<td>13.</td>
<td>Peon</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

* Either qualified or specially trained to work as surgeon, obstetrician, physician and paediatrician. One of the existing medical officers similarly should be either qualified or specially trained in public health.

1.1.4 Norms and Achievements

The population norms for each level of infrastructure are as follows:

<table>
<thead>
<tr>
<th>Centre</th>
<th>Population Norms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plain Area</td>
</tr>
<tr>
<td>Sub-Center</td>
<td>5000</td>
</tr>
<tr>
<td>Primary Health Centre</td>
<td>30,000</td>
</tr>
<tr>
<td>Community Health Centre</td>
<td>120,000</td>
</tr>
</tbody>
</table>

The achievements as on 2007 are given below:

<table>
<thead>
<tr>
<th>Centre</th>
<th>No. functioning as on Mar 07</th>
<th>Average area (sq.km) covered</th>
<th>Average radial distance (km) covered</th>
<th>Average No. of villages covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-centre</td>
<td>145,272</td>
<td>21.47</td>
<td>2.61</td>
<td>4</td>
</tr>
<tr>
<td>PHC</td>
<td>22,370</td>
<td>139.40</td>
<td>6.66</td>
<td>29</td>
</tr>
<tr>
<td>CHC</td>
<td>4,045</td>
<td>770.90</td>
<td>15.66</td>
<td>158</td>
</tr>
</tbody>
</table>
1.1.5 **Staff Position.** The position of some of the staff in the health care establishments as on Mar 2007 is given below:

<table>
<thead>
<tr>
<th>Staff</th>
<th>Sanctioned (S)</th>
<th>In position (P)</th>
<th>Vacant (S-P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctors at PHC</td>
<td>27274</td>
<td>22608</td>
<td>4920</td>
</tr>
<tr>
<td>HA (M) at PHCs</td>
<td>25981</td>
<td>20234</td>
<td>5747</td>
</tr>
<tr>
<td>HA (F) /LHV at PHCs</td>
<td>18029</td>
<td>15546</td>
<td>2497</td>
</tr>
<tr>
<td>LTs at PHCs &amp; CHCs</td>
<td>15773</td>
<td>12101</td>
<td>3672</td>
</tr>
<tr>
<td>HW (M) at SCs</td>
<td>92791</td>
<td>62881</td>
<td>29653</td>
</tr>
<tr>
<td>HW (F) at SCs/PHCs</td>
<td>161445</td>
<td>147439</td>
<td>14180</td>
</tr>
</tbody>
</table>

1.1.6 **Strengthening of Rural Health Infrastructure under the National Rural Health Mission (NRHM)**

The NRHM was operationalized from April 2005 throughout the country, with special focus on 18 states which includes 8 Empowered Action Group (EAG) states (Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Uttarakhand, Orissa and Rajasthan) and 8 North Eastern States (Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura), Himachal Pradesh and Jammu & Kashmir.

The main aim of NRHM is to provide accessible, affordable, accountable, effective and reliable primary health care, especially to poor and vulnerable sections of the population. It aims to achieve this aim through creation of a cadre of Accredited Social Health Activists (ASHAs), improved hospital care, decentralization of programme to district level to improve intra- and inter-sectoral convergence and effective utilization of resources. The mission further seeks to build greater ownership of the programme among the community through involvement of Panchayati Raj institutions, NGOs and other stakeholders at National, State, District and Sub-district levels.

1.1.6.1 **ASHAs.** The details regarding ASHA are as follows:

Every village/large habitat will have a female Accredited Social Health Activist (ASHA) chosen by and accountable to the panchayat, to act as the interface between the community and the public health system.

ASHA acts as a bridge between the ANM and the village and be accountable to the Panchayat.

She is an honorary volunteer, receiving performance-based compensation for promoting universal immunisation, referral and escort services for RCH, construction of household toilets, and other healthcare delivery programmes. The role of ASHAs in NVBDCP is given below:
She is trained on a pedagogy of public health developed and mentored through a Standing Mentoring Group at National level incorporating best practices and implemented through active involvement of community health resource organisations.

She will facilitate preparation and implementation of the Village Health Plan along with Anganwadi worker, ANM, functionaries of other Departments, and Self-Help Group members, under the leadership of the Village Health Committee of the Panchayat.

ASHAs are being promoted all over the country, with special emphasis on the 18 high focus States. The Government of India bears the cost of training, incentives and medical kits. The remaining components will be funded under Financial Envelope given to the States under the programme.

She is given a Drug Kit containing generic AYUSH and allopathic formulations for common ailments. The drug kit are being replenished from time to time.

Induction training of ASHA is of 23 days in all, spread over 12 months. On the job training would continue throughout the year. Prototype training material has been developed at the National level and modified at State level. Cascade model of training is done through Training of Trainers including contract plus distance learning model. Training involves partnership with NGOs/ICDS Training Centres and State Health Institutes.

1.2 Urban Health Care System

Nearly 30 per cent of India’s population lives in the urban areas. The urban migration of population from rural areas has resulted in rapid growth of slums. The population of slums faces health hazards due to over-crowding, poor sanitation, lack of access to safe drinking water and environmental pollution. Studies have shown that health indices of urban slum dwellers in some areas are worse than those of rural population.

Majority of the hospitals and beds, doctors and paramedical staff in the country are in urban areas. There are Urban Health Centres, Health Posts and dispensaries in many urban areas. However, there are no well structured geographically delineated primary and secondary health care facilities in most of the cities and towns. Moreover, there is over-crowding in most of the available centres. Inappropriate use of diagnostic and therapeutic facilities is also resulting in escalating cost of health care without commensurate health benefits.
Realizing that the available infrastructure is insufficient to meet the health care needs of the growing urban population, the municipalities, state governments and the central government have tried to build up the urban health care facilities. Funds provided by corporations/municipalities, state government, central government and externally assisted projects are taken up to achieve the goal of providing comprehensive and affordable health care in urban areas.

1.2.1 Urban Malaria Scheme

Due to serious hazards to the National Malaria Eradication programme due to urban malaria problem, it was realized that urban areas with 40,000 population and above having A. stephensi problem should be brought under the purview of NMEP for implementing antilarval operations as a complementary to the programme in rural areas. The Urban Malaria Scheme (UMS) came into existence in 1971 covering 23 towns initially and now the scheme is in operation in 131 states/UTs.

The main objective is to control malaria by reducing the vector population in the urban areas through recurrent antilarval measures, since indoor residual insecticidal spray is not acceptable to the urban population.

The norms for establishment of UMS are as follows:
- The towns should have a minimum population of 40,000
- The API should be 2 or above
- The towns should promulgate and strictly implement the civil bye-laws to prevent/eliminate domestic and peri-domestic breeding places.

1.2.1.1 Control strategy. The components of UMS strategy are as follows:

- Source Reduction
- Antilarval measures
  - Chemical methods
  - Biocides
  - Biological control
  - Aerosol space spray
  - Antiparasitic measures
Learning Unit 2. Introduction to malaria and Life Cycle of Malarial Parasite

2.1 What is Malaria?

Malaria is a disease transmitted by the female anopheles mosquito. The parasite which causes malaria is the plasmodium (a unicellular organism). Malaria is a global health problem; worldwide 300-500 million people develop malaria every year. In India the number of recorded cases is about 1.5 million per year, but it is estimated that the real number may be much higher. About thousand deaths due to malaria are reported every year by NVBDCP, but as many hospitals do not report malaria cases to the programme, the real number is thought to be much higher.

2.2 Malaria Control programme in India

Malaria has been a problem in India for centuries. Details of this disease can be found in the ancient Indian Medical Literature like the “Charaka Samhita”. In the 1930s there was no aspect of life in the country that was not affected by malaria. The annual incidence of malaria was estimated at around 75 million cases in 1953, with about 8 lakh deaths. To combat this menace, the Govt. of India launched the National Malaria Control Programme (NMCP) in April 1953. The programme was highly successful and within 5 years, the incidence dropped to 2 million cases. Encouraged by this, the programme was changed to a more ambitious National Malaria Eradication Programme (NMEP) in 1958. By 1961 the incidence dropped to a mere 50,000 cases a year. But since then the programme suffered repeated setbacks due to technical, operational and administrative problems, and cases started rising again. In the late 1960’s malaria cases in urban areas started to increase and surges of malaria in rural areas were also widespread. As a result in 1976, 6.47 million cases were recorded by the malaria control programme, the highest since resurgence began. In the year 1995 Malaria Action Programme (MAP) was taken up in high risk areas. The National Malaria Eradication programme was renamed as National Anti Malaria Programme (NAMP) in 1999 covering the concept of effective control. In 2004 the programme was integrated with other vector borne diseases control and was named as the National Vector Borne Disease Control Programme (NVBDCP).

The reported malaria incidence is now about 1.5 million cases per year. Over the last few decades, the proportion of falciparum malaria has increased; and the drug resistance of _P.falciparum_ and insecticide resistance of vectors threaten to
cause setbacks. Malaria therefore remains one of the most important public health problems of India, despite continuous efforts at its control.

The Strategy of malaria control in India is three pronged comprising of Early Diagnosis and Prompt Treatment (EDPT), Integrated Vector Management (IVM) and Supportive interventions like Training for capacity building, Behaviour Change Communication (BCC), intersectoral coordination, Public Private Partnerships (PPP), community participation and legislation.

2.3 Types of Malarial Parasite

In India two types of plasmodia are responsible for most human malaria.—They are *Plasmodium vivax* (*P. vivax*, PV) and *Plasmodium falciparum* (*P. falciparum*, PF). There are two other plasmodia (*Plasmodium malariae* and *Plasmodium ovale*) that cause malaria in humans, but they are rare and of practicably no public health importance in India. *P. falciparum* is the variety which is responsible for almost all the deaths due to malaria. *P. vivax* causes debilitating illness, but vivax malaria is rarely fatal, unless accompanied by some other problem like malnutrition. In many states of India, particularly the North Eastern states, Orissa and Chhattisgarh, a very high proportion of malaria cases are due to *P. falciparum*.

2.4 Life Cycle of the Malarial Parasite

The malarial parasite undergoes 2 cycles of development – the human cycle (asexual cycle) and the mosquito cycle (sexual cycle). Man is the intermediate host and mosquito the definitive host.

2.4.1 Asexual cycle in human being

The asexual cycle begins when an infected anopheles mosquito bites a person and injects sporozoites. There are 3 phases in the human cycle.

2.4.1.1 Hepatic Phase

The sporozoites disappear within 60 minutes from the peripheral circulation. Many of them are destroyed by phagocytes, but some reach the liver cells. After 1-2 weeks of development (depending upon the species), they become hepatic schizonts, which eventually burst releasing a shower of merozoites. The number of merozoites produced from a single sporozoite varies – as many as 40,000 in *P. falciparum*, whereas only 200 – 15,000 in other species. In *P. falciparum*, the intrahepatic schizonts rupture almost simultaneously and there is no persistent tissue phase (exo-erythrocytic phase). In other species, the hepatic forms may remain dormant (hypnozoites) for long periods, liberating merozoites at various intervals, causing relapses of malaria.
2.4.1.2 Erythrocytic Phase

Many of the merozoites released from the liver cells are quickly destroyed, but a significant number attach themselves to specific receptor sites on the RBCs, penetrate them and pass through various stages of trophozoite and schizont. The erythrocytic phase ends with the liberation of merozoites, which infect fresh RBCs. The clinical feature of fever with chills coincides generally with the rupture of RBCs. The cycle is repeated over and over again until the condition worsens or when it may be slowed down by the immune response of the host. The duration of each erythrocytic cycle varies between species – 48 hours for P. falciparum, P. vivax and P. ovale; and 72 hours for P. malariae.

2.4.1.3 Gametogony

Some of the erythrocytic forms of plasmodia do not divide further but develop into male and female gametocytes. Not all infected persons are infectious (can infect anopheline mosquitoes). The blood of the person has to have mature male and female gametocytes and the density should be minimum 12/ cumm of blood to be infective. These gametocytes take over a week to appear in the blood. Gametocytes do not cause any symptoms in humans. Most drugs like chloroquine kill the asexual forms that cause the fever but leave intact the sexual forms that are infective especially in case of *P falciparum*. Thus an apparently normal person may harbour the disease and contribute to its spread.

Figure 1. Life Cycle of *Plasmodium* species in man and the mosquito
2.5 Spread of malaria

The plasmodia spread from person to person by the bite of mosquitoes. This process is called the **transmission** of the disease, and the mosquitoes are the **vectors** of malaria. However, not all mosquitoes can act as malaria vectors. It is only mosquitoes belonging to the genus *Anopheles* - and that too the female of the species which can carry the parasite and infect. Male *Anopheles* mosquitoes only feed on plant juices and nectar and cannot transmit malaria.

2.5.1 Sexual Cycle in Mosquito

The mosquito cycle (sporogony) begins when gametocytes are ingested by the vector mosquito while feeding on an infected person. The male gametocytes, after reaching the stomach of the mosquito and develop into 4-8 filaments called “microgametes”. The female gametocyte undergoes maturation to become a “macrogamete”. The microgametes get attracted to the macrogamete, and one of the microgametes fertilizes the macrogamete. The resulting zygote is at first motionless, but within 18-24 hours, becomes a motile ookinete, which penetrates the stomach wall of the mosquito and develops into an oocyst on the outer
surface of the stomach. The oocyst further develops into numerous sporozoites, when the oocyst ruptures and releases the sporozoites into the body cavity of the mosquito. Many of the sporozoites migrate to the salivary glands and the mosquito becomes infective to man. The period required for the development of the parasite from the gametocyte stage to sporozoite stage is about 10-20 days depending on atmospheric temperature and humidity. This period is known as the “extrinsic incubation period”. The sporozoites (the infective stage of *Plasmodium*) are injected with saliva when the mosquito next feeds.

In falciparum malaria, there may be involvement of the brain and coma in addition to life threatening complications including kidney or liver failure. With early and effective treatment, the case fatality rates in *P. falciparum* malaria can be brought down from above 5% to close to zero. Malaria cases can be classified according to the parasite species causing them and according to the severity of the disease, as either uncomplicated or severe malaria. It should be understood that severe vivax malaria is very rare.

### 2.6 Immunity to malaria

Repeated infections with malaria parasites lead to the acquisition of antibodies directed against various antigens of various stages of malaria parasites as well as cell-mediated immunity. The immunity is to a large extent, but not completely, specific to the species of malaria parasite. It is also to some extent strain-specific, meaning that a person, who has been exposed to malaria in a certain part of the world (or part of a large country like India) will have a higher degree of immunity to local malaria parasites than to those from a distant location. There is no perfect immunity to malaria: nobody acquires such a high level of protective antibodies that he or she can be certain not to contract malaria. Also, in contrast to many other communicable diseases, the immunity to malaria is time-limited: the person who has acquired a certain degree of immunity through repeated malaria attacks will lose that immunity in a few years, if the exposure is not maintained. For this reason, sometimes the terms semi-immunity or premunition are preferred to immunity.

Typically in areas with very intense transmission, persons who are heavily exposed, acquire some immunity in childhood. Then as adults, they get ill relatively rarely and when they do, the disease is mild and of short duration. It seems that in old age, immunity is lost again, but it is not clear whether this is a result of ageing processes or of old people being less exposed to malaria or both. Typically, people with a certain degree of immunity still harbour parasites: They are asymptomatic carriers. It can be difficult to detect such cases and this can have implications for malaria control. If a certain population is heavily exposed to malaria, so that some people have some immunity to the disease and exposure is reduced for some years as a result of control measures, the immunity will largely be lost. If control is then relaxed, malaria may return with
occurrence of large number of cases. For this reason, sustainability is important in malaria control.

Scientific work to develop a **malaria vaccine** has taken place for decades. One or two vaccines may well be marketed within the coming 5 years, but they are likely to have only a limited degree of effectiveness and would, at best, only be a supplement to other malaria control tools.

Malaria is a serious disease, which has affected human populations for many thousands of years. It has therefore exerted a selective pressure, favouring certain genotypes in humans with some innate (in contrast to acquired, as described above) immunity to malaria. Among these conditions are sickle cell disease, thalassaemia and glucose-6-phosphate dehydrogenase deficiency, all of which are common in India, especially in populations which are or have in the past been heavily exposed to malaria.

### 2.8 Malaria Control

Malaria control comprises all activities undertaken to reduce the burden of malaria in a given population. It includes the diagnosis and treatment of malaria cases and prevention. Surveillance of the disease, prevention and control of epidemics and field studies to regularly assess the malaria situation and its determinants are essential components in a malaria control programme. The main methods of prevention aim to reduce the risk of humans being bitten by infected anopheline mosquitoes. The aim of malaria control is to reduce morbidity and mortality of malaria to the lowest possible levels locally. In some cases, the aim may be elimination, i.e. the interruption of transmission, where no new cases occur.

#### 2.8.1 Diagnosis and treatment

Uncomplicated malaria can become severe malaria within 1-2 days (shorter for young children) of onset of symptoms. Early and effective treatment will halt the progression of the disease, thereby preventing deaths from occurring. This could be achieved by treating everybody with a fever as malaria, and this was in fact done until recently as “presumptive treatment”. Nowadays, because of drug resistance, it is necessary to use more expensive and differentiated treatment regimens. The strategy of presumptive treatment has therefore been replaced by early diagnosis (through RDTs or microscopy) followed by prompt, effective treatment. Early effective treatment benefits not only the individual patient, but also has the following advantages:

a) Lowering the infectivity of infected persons to the mosquito vector will contribute to reducing malaria transmission, and eventually the incidence of malaria.
b) Early diagnosis is important because in the early stages the infected persons have only asexual forms of plasmodia in the blood, which are not infective to mosquitoes. It takes about 4 - 5 days after the person has developed fever to develop the sexual forms of *P. vivax* in the blood; for *P. falciparum* it takes 8 -10 days. If the blood is cleared of the parasites during this time, then the transmission from that person is prevented.

c) In low transmission areas, where most infective people are symptomatic, treating all cases within the first week could cut transmission dramatically. In high transmission areas, where there are many asymptomatic carriers, case management alone has relatively little role in transmission control.

d) Most antimalarial medicines have no significant action on the gametocytes, whereas primaquine can effectively destroy them. Artemisinin derivatives have some effect on gametocytes, but it is not as constant as that of primaquine. Therefore, primaquine is included in the treatment of falciparum malaria, because some patients only report after they have developed gametocytes.

### 2.8.2 Measures directed against the transmission by mosquitoes

#### 2.8.2.1 Transmission dynamics

It is important to have a basic knowledge of the transmission dynamics to understand malaria control. The intensity of malaria transmission in an area is the rate at which people are inoculated with malarial parasites by mosquitoes. It is expressed as the annual Entomological Inoculation Rate (EIR) i.e. the average number of infectious bites by malaria-infective mosquitoes delivered to an individual human resident in that area per year. Annual EIRs range from 500 to 1000 in certain parts of Africa to about 10 to 100 in places where there are seasonal peaks. At levels of about 0.01 or less, malaria transmission is barely and rarely sustained.

The EIR can go down, if:

a) There are fewer people, who have gametocytes in their blood; so that the probability of a mosquito becoming infected upon biting a human being is reduced.

b) Total population of mosquitoes has decreased.

c) People have taken measures to avoid mosquito bites.

d) More animals are available as sources of blood meals, provided the vectors are zoophilic.
e) Average life-span of vectors has been reduced, so that only a few of those infected become infective for human beings.

Field studies and mathematical models have shown that in most situations the most effective vector control methods are the ones, which include reduction of life-span of vectors. The explanation is that the average life-span of a female anopheline is only a little longer than the extrinsic incubation period. Thus, a 20% reduction of the average life-span of female anophelines may lead to a situation, where no or very little transmission takes place. In contrast, even if the density of anophelines is reduced by, for example 80%, the remaining 20% will be able to maintain some transmission. In practice, methods which reduce the life-span of anophelines may also reduce their density and the frequency with which they bite humans.

### 2.8.3 Behaviour Change Communication (BCC)

The NVBDCP envisages strong community participation and behavior change components in the malaria control program to meet the challenges in malaria control. Three interventions of proven value are now being introduced at a large scale into the program, each of which has benefits tangible even to the lay person, and thus having high likelihood of acceptability and utilization:

#### 2.8.3.1 Diagnosis.

In the place of slide tests which involved delay in getting results, rapid diagnostic tests (RDT) for *P. falciparum* are now available. These tests can be conducted at the most peripheral levels by any one with simple training.

#### 2.8.3.2 Treatment.

In place of Chloroquine which was associated with treatment failure due to drug resistance, ACT is now available which is nearly 100% effective and is not associated with any major side effects.

#### 2.8.3.3 Bed nets.

In place of Insecticide impregnated Bednets which required periodic reimpregnation, soon we will have Long lasting bed nets which do not require reimpregnation, remaining effective even after 20-25 washes and lasting for 3-5 years.

A fourth component of the program having high acceptance potential is the establishment of trained ASHAs at village level, known as ASHAs. The malaria control program offers considerable scope for communities to participate in and own the program.

### 2.9 Vulnerable groups

Certain groups are particularly vulnerable to malaria:
Pregnancy increases vulnerability of women to severe malaria, by lowering immunity. Malaria can cause abortion, stillbirth, low birth weight and severe anaemia in pregnant woman. Early and complete treatment of malaria is therefore of the greatest importance in pregnant women.

Young children are at highest risk in those populations, which are exposed to very intense transmission, where older people develop immunity. Even in areas with less intense transmission, severe disease may develop particularly rapidly in young children. Diagnosis may be difficult, as young children can have fever from a number of different causes.

People who do not live in malaria-endemic areas have no immunity. The problem of immigrants may be a lack of knowledge of malaria and about where to go for treatment if they fall ill. Travellers, tourists and immigrants need information on protective measures against malaria in various locations and situations.

### 2.10 Malaria and gender

Women are more likely to delay visits to qualified health care providers and more likely to visit traditional healers for their sickness and for their children because of their lesser control over resources and decision-making process in the household. There may be a gender bias towards the male child, who gets preferential attention in getting health care. Studies have shown that women in many situations do not have control over decision making about accessing quality health care. Malaria in pregnant women is associated with more serious complications.

When men have malaria the household becomes severely affected economically. Women’s work days become longer and the work load becomes heavier as they have to take care of the ill apart from their routine activities. There may also be times when they have to go for work to compensate for the wage loss of the male members. In households without any male earning member, the economic consequence can be very severe on the entire family.

There is a need to promote women’s active participation in leadership and decision-making. It is critical that people at every level come together to create awareness of the magnitude of the problem and on the way gender inequalities lead to a greater impact on women and the girl child in case of sickness due to malaria.
Learning Unit 3. Malaria Entomology

3.1 Malaria entomology is the study of biology and ecology of the mosquitoes that transmit malaria. There are more than 4000 species of mosquitoes in the world of which about 424 belong to Anopheline group, and about 70 are considered to be the main vectors of malaria. In India there are about 53 species of anopheline mosquitoes and of these nine are vectors for malaria; only six of them being important primary vectors. The other three can contribute to spread of malaria but by themselves cannot initiate or sustain transmission (secondary vectors).

3.2 Distinguishing mosquitoes from other insects

Mosquitoes belong to the class Insecta – having the following characteristics:
- the body is divided into three sections—head, thorax and abdomen
- the head has one pair of antenna, and a pair of compound eyes
- the thorax has three pairs of legs

The main parts of the adult mosquito are shown in Figure 3.1 below. Four characteristics can be used to describe adult mosquitoes: only one pair of wings; a long proboscis; the body is covered with scales; and wings have veins that show a defined pattern

Figure 3.1 Main parts of the adult mosquito

3.3 Distinguishing anophelines from culicines
Distinguishing characteristics of anophelines and culicines are illustrated in Figs. 2.2 and 2.3.

<table>
<thead>
<tr>
<th>Anophelines</th>
<th>Culicines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Larva</td>
<td>Water surface</td>
</tr>
<tr>
<td>Breathing trumpet</td>
<td>Siphon</td>
</tr>
<tr>
<td>Pupa</td>
<td>Water surface</td>
</tr>
<tr>
<td>Adult</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.2 Comparison between anopheline and culicine mosquitoes

3.3.1 Eggs

Culicine eggs clump together in a "raft" (Culex) or float separately (Aedes); anopheline eggs float separately and each of them has "floats".

3.3.2 Larvae

The culicine larva has a breathing tube (siphon) which it also uses to hang down from the water surface, whereas the anopheline larva has no siphon and rests parallel to and immediately below the surface.

3.3.3 Pupae
Pupae of both anophelines and culicines are comma-shaped and hang just below the water surface. They swim when disturbed. The breathing trumpet of the anopheline pupa is short and has a wide opening, whereas that of the culicine pupa is long and slender with a narrow opening. However, it is difficult to distinguish anopheline from culicine pupae in the field.

### 3.3.4 Adults

Live adult anopheline and culicine mosquitoes, can easily be distinguished by observing their resting postures. Anophelines rest at an angle between 50° and 90° to the surface whereas culicines rest more or less parallel to the surface. Anopheline mosquitoes can also be distinguished from culicines by the length and shape of the palps. The differences (Fig. 2.3) are:

- In female anophelines, palps are as long as proboscis; in female culicines, palps are very much shorter than proboscis.
- In male anophelines, palps are as long as proboscis and club-shaped at tip; in male culicines, palps are longer than proboscis, with tapered tips.

![Diagram of adult anopheline and culicine mosquitoes](image)

**Figure 2.3** Heads of male and female anopheline and culicine mosquitoes

### 3.4 Distinguishing female *Anopheles* from males

It is important to distinguish females from males because only the female *Anopheles* takes blood meals and transmits malaria; on the antennae of the
female the hairs are few in number and short (Fig. 2.3). The male has very long hairs on the antennae, which consequently have a bushy appearance.

3.5 Life cycle of anopheline mosquitoes

All mosquitoes have four different stages in their life cycle: the **egg**, **larva**, **pupa** and **adult**.

3.5.1. Eggs

A female anopheline mosquito normally mates only once in her lifetime. She usually requires a blood meal after mating for development of eggs. Blood meals are generally taken every 2-3 days before the next batch of eggs is laid. About 100-150 eggs are laid on the water surface during oviposition. Oviposition sites vary from small hoof prints and rain pools to streams, swamps, canals, rivers, ponds, lakes and rice fields. The average lifespan of female anopheline mosquitoes is about 3-4 weeks.

**Figure 3.3 Life cycle of an Anopheles mosquito**

3.5.2 Larva

A larva hatches from the egg after about 1-2 days. The anopheles larva floats parallel under the water surface, since it needs to breathe air. It feeds by taking up food from the water. When disturbed, the larva quickly swims towards the bottom but soon needs to return to the surface to breathe. There are four larval stages or **instars**. The total time spent in the larval stage is generally 8-10 days at normal tropical water temperatures. At lower temperatures, the aquatic stages take longer to develop.
3.5.3 Pupa

The pupa is shaped like a comma and it’s a non feeding stage. It stays under the surface and swims down when disturbed. The pupal stage lasts for two to three days after which the skin of the pupa splits. Then the adult mosquito emerges and rests temporarily on the water’s surface until it is able to fly.

3.5.4 Adult

Mating takes place soon after the adult emerges from the pupa. The first batch of eggs develops after one or two blood meals, while successive batches usually require only one blood meal. The feeding and resting habits of mosquitoes are of great importance in control programmes and for this reason they must be well understood. Most anopheline mosquitoes bite at night. Some bite shortly after sunset while others bite later, around midnight or the early morning. Some mosquitoes enter houses to bite and are described as being endophagic; others bite mostly outside and are called exophagic.

After the mosquito takes a blood meal she usually rests for a short period. Mosquitoes that enter a house usually rest on a wall, under furniture or on clothes hanging in the house after they bite and are said to be endophilic. Mosquitoes that bite outside usually rest on plants, in tree holes, on the ground or in other cool dark places and are called exophilic.

Host preferences are different for different species of mosquitoes. Some mosquitoes prefer to take blood from humans rather than animals and are described as being anthropophagic/anthropophilic while others only take animal blood and are known as zoophagic/zoophilic. Clearly, those who prefer to take human blood are the most dangerous as they are more likely to transmit malaria from person to person.

3.6 Malaria vectors of India

The important malaria vectors in India are:

a. *Anopheles culicifacies*: The most common vector in India, especially in rural areas and is widely distributed in India. Occurs sporadically in N.E. India. Not reported in Andaman & Nicobar Islands and Lakshadweep.

b. *Anopheles fluviatilis*: Important vector in hilly and forested areas. Widely distributed in the foothill areas including both peninsular and North East India

c. *Anopheles stephensi*: Distributed throughout India except at higher altitudes. Found only sporadically in the North East. Almost all urban malaria is due to this species.
d. *Anopheles sundaicus*: Typical of seashores; low importance except on islands. Responsible for malaria transmission in Andaman & Nicobar islands only.

e. *Anopheles minimus*: Of great importance in the north east India, breeding in slow-moving streams with grassy margins, mainly in foothills.

f. *Anopheles dirus*: Vector in forested and forest fringe area in the north-east. Highly exophilic and exophagic and difficult to breed in small, transient, partly shaded pools in forest areas (eg. Elephant footprints).

g. *Anopheles annularis*: Mainly a secondary vector, which is common in central India and Orissa.

h. *Anopheles philippinensis*: It is incriminated as a vector in deltaic West Bengal and N.E. India. Breeds mainly in paddy fields.

i. *Anopheles varuna*: Secondary vector in Andhra Pradesh, Jharkhand and Orissa.

### 3.7 Bionomics of important vector species.

The behaviour of the four important vector species is given below:

<table>
<thead>
<tr>
<th></th>
<th><strong>An. culicifacies</strong></th>
<th><strong>An. stephensi</strong></th>
<th><strong>An. fluvialis</strong></th>
<th><strong>An. minimus</strong></th>
<th><strong>An. dirus</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site of breeding</strong></td>
<td>Water in paddy fields, wells, irrigation wells, step wells, ponds, cattle water storages, cattle foot prints</td>
<td>Clean water in water tanks, water logged in trenches, large clean water puddles, upturned cans, etc</td>
<td>Rock pools, hilly streams, ponds</td>
<td>Shaded slow flowing streams with grassy margins, swamps, ditches, channels</td>
<td>small, transient, partly shaded pools in forest areas (eg. Elephant footprints)</td>
</tr>
<tr>
<td><strong>Zoophilic/anthropophilic</strong></td>
<td>Zoophilic; Occasionally anthropophilic</td>
<td>Zoophilic/Athropophilic according to availability</td>
<td>Anthropophilic</td>
<td>Highly anthropophilic</td>
<td>Highly anthropophilic</td>
</tr>
<tr>
<td><strong>Seasonal</strong></td>
<td>Peaks</td>
<td>Rainy</td>
<td>Peaks in</td>
<td>Perennial</td>
<td>Rainy</td>
</tr>
<tr>
<td></td>
<td><strong>An. culicifacies</strong></td>
<td><strong>An. stephensi</strong></td>
<td><strong>An. fluviatilis</strong></td>
<td><strong>An. minimus</strong></td>
<td><strong>An. dirus</strong></td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td>----------------</td>
<td>--------------</td>
</tr>
<tr>
<td><strong>Peak Time of biting</strong></td>
<td>during monsoon months</td>
<td>months</td>
<td>late monsoons and early winter months</td>
<td>months</td>
<td>months</td>
</tr>
<tr>
<td><strong>Preferred place of biting</strong></td>
<td>Varies – (1900 to 0400)</td>
<td>Varies- (2200 to midnight)</td>
<td>Late night (2300 to 0300)</td>
<td>1800 to 1900 (Outdoors); Midnight to 0200 (Indoors)</td>
<td>2100 – 03:00 Hrs</td>
</tr>
<tr>
<td><strong>Resting behaviour</strong></td>
<td>Endophilic</td>
<td>Endophilic</td>
<td>Endophilic/ Exophilic</td>
<td>Endophilic/ Exophilic</td>
<td>Exclusively Exophilic</td>
</tr>
<tr>
<td><strong>Biological efficiency as vector</strong></td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
Learning Unit 4. Case detection

4.1. Objectives of Malaria Case Management

The objectives of malaria case management are:

- To prevent severe malaria and death in patients presenting with uncomplicated malaria
- To shorten the duration of symptoms
- To reduce malaria transmission
- To prevent relapses of vivax malaria

4.2 Recognition of malaria

A person having malaria almost always has fever. Usually, the person gets sudden high fever and chills. The fever may come every day or every other day. Usually there is headache and body ache also. There may be vomiting. But any of these symptoms can be caused by diseases other than malaria. Common causes of fever other than malaria are common cold, sore throat, pneumonia, infected ear, infected wound, abscess, urinary infection, etc. So, it is difficult to say from symptoms alone whether someone has malaria.

4.3 Diagnosis of malaria

A patient with fever in endemic area during the transmission season or who has visited an endemic area without any other obvious cause of fever, is considered a case of suspected malaria. In practice the ascertainment of an “obvious cause” can only be expected from well-trained and experienced health staff. A volunteer or health activist working in a high-risk area should be taught to consider any fever case in the absence of specified symptoms as suspected malaria. Any volunteer, health worker or health professional observing a case of suspected malaria must immediately do Rapid Diagnostic Test (RDT) and also prepare blood smear for examination of malarial parasites. These tests will reveal whether a person has malaria or not.

4.4 Blood tests to detect malaria

There are two kinds of blood tests for detecting malaria:

4.4.1 Slide test

A few drops of blood are taken from a finger and spread on a glass slide. The glass slide is then examined by a trained laboratory technician under a microscope. If the technician sees Plasmodium organisms in the smears, the slide test is reported positive.
If the slide is made by a health worker at home in the village, it has to be sent to the laboratory, and it may take few days for the report to get back to the patient. This method has the advantage that it can detect all types of malaria.

### 4.4.2 Rapid Diagnosis Test (RDT)

One drop of blood is taken from a finger and immediately placed on a test strip. A few drops of a solution are added, and a few minutes later, a red line appears on the strip. If two red lines appear, the test is positive for falciparum malaria.

At present, this test can detect only falciparum malaria, the dangerous form. The advantage of this method is that it is easy to learn, there is no need for a laboratory, and it takes only 15 minutes to get the result and patients can be treated early. The Rapid Diagnostic Test (RDT) is thus very useful for detecting the dangerous form of malaria (P.f) early and saving lives. It is expensive, but is supplied by the Government of India free of cost.

### 4.4.3 Which of the tests is to be used?

ASHAs who live very close to the laboratory will need to do only the slide test, because it will be possible for them to get the test result from the laboratory on the same day or, at the most, the next day. Those ASHAs who live far from the laboratory should do both the tests, RDT and slide, from a single finger prick. The RDT will first be read in 15 minutes.

If the RDT is positive, treatment for falciparum malaria is given and there is no need for sending the slide to the laboratory.

If the RDT is negative, the person may be having vivax malaria or fever due to any other cause. In this case, the slide is sent to the laboratory and the result awaited. If the slide is positive for P. vivax, then the appropriate treatment is given. If negative, the patient should be referred to be treated at the PHC.

### 4.5 Drawing blood from a finger prick

To do the blood test, the blood is drawn from a finger prick.

#### 4.5.1 Requirements to draw blood

1. Spirit swab
2. Cotton
3. Lancet

### 4.6 Preparation of blood smear
For preparation of blood smears the items required are Clean glass slides, Disposable Lancet, Spirit or Cotton swab for cleaning the finger, Cotton, Clean piece of cotton cloth, Slide box for 25 slides, Lead pencil, Register and MF form. After the patient information has been recorded on the appropriate form, the blood films are made as per the following steps:

1. Select the second or third finger of the left hand and clean with spirit swab

2. The site of the puncture is the side of the ball of the finger, not too close to the nail bed. This part of the finger should be pricked with a lancet, using one quick, firm movement.

3. Gently wipe the tip of the finger with cotton, and then allow the blood to flow out on its own. Allow the blood to come up automatically. Do not squeeze the finger.

4. Hold the slide by its edges

5. The size of the blood drop is controlled better if the finger touches the slides from below

6. Touch the drop of blood with a clean slide, three drops are collected for preparing the thick smear

7. Spread the drop of blood with the corner of another slide to make a circle or a square about 1 cm

8. Bring the edge of the slide carrying the second drop of blood to the surface of the first slide, wait until the blood spreads along the whole edge

9. Holding it at an angle of about 45° push it forward with rapid but not too brisk movement. Write with a pencil the slide number on the thin film, Wait until the thick film is dry
4.7 Rapid Diagnosis Test (RDT)

4.7.1 Requirements

The Rapid Diagnosis Test (RDT) is done with the Rapid Diagnosis Test Kit (RDK). This kit is regularly supplied by the government through the nearest Primary Health Center. The kit contains the following materials:

1. Spirit swabs - one swab for one patient
2. Lancets - one lancet for one patient
3. Small glass tube (capillary tube) - one for each patient
4. Test strips - one strip for one patient
5. One multiple-well plastic plate - common for all tests
6. Test tube – one test tube for one patient
7. Buffer solution or reagent solution - a special liquid for doing the test, in a dropper bottle, common for all tests

4.7.2 Procedure

1. Check that the test kit is within its expiry date. If not, do not use it.
2. Place your waste box close by.
3. Open a foil pouch and check that the powder inside it is still blue. If not, discard the test and use another test.
4. Remove the test strip and the small glass tube or loop from the foil pouch and place them on a clean dry surface.
5. Take out the bottle containing the liquid and the dropper.
6. Place a new test tube in the multiple-well plate.
7. After drawing blood from a finger as described, touch the tip of the small glass tube to the blood drop on the finger and let a small amount of blood come up in the tube or the loop.
8. Touch the tube or the loop to the test strip just below the arrow mark to place the blood there. If there is a paper where *Plasmodium falciparum* is
written, remove it and place the blood on the strip in the place that was covered by the paper.
9. Put the used small glass tube in waste box.
10. Using the dropper, place 4 drops of liquid from the bottle into the new test tube that you had placed in the multiple-well plate.
11. Place the test strip containing blood in this test tube with the arrow pointing down, with the tip of the strip dipped in the liquid.
12. Wait for about 15 minutes. During this time, you can prepare the blood smear on a slide.
13. Observe the test strip after 15 minutes. You will find one of the following situations:
   a. No red line appears on the test strip - this means that the test strip is not working. Discard it and repeat the test carefully with a new test strip, starting with the first step.
   b. A single red line appears - this means that the patient does not have falciparum malaria. You need to send a slide to the laboratory to check if the patient may have the less dangerous form, vivax malaria.
   c. Two red lines appear - this means that the patient has falciparum malaria. Treat the patient for falciparum malaria, as described later. There is no need to send the blood slide to the laboratory.
14. After the test has been read, put the test strip and test tube into the waste box along with all used swabs and the used lancet.

Since the RDK may come from different companies at different times, there may be small differences in the contents and in the manner in which the test is done. The PHC staff will be able to clarify on this issue.

4.7.3 Storage of RDKs

The RDK should be stored in a cool, dry place indoors and should not be exposed to sunlight. The RDT may not give you correct results if it is exposed to sunlight or if it becomes wet. Therefore, it is very important to store the RDK carefully.

4.8 Safe Disposal of Materials used for Blood Tests

All the materials used in performing blood tests are unsafe for people to handle. Blood from patients can contain organisms that can cause disease. So, any materials that have been contaminated by blood, such as swabs, lancets, used and discarded slides, test strips and test tubes should be handled with care. They should be collected in a waste box having a lid. The box should be kept firmly closed and should be stored in a place out of reach of children. When the box is full, it should be buried in a deep hole in the ground away from wells and other sources of water. Or, the box can be given to the MPHW for disposal.
4.9 Protecting the Patient and Self while doing Blood Tests

If your hands are dirty when you do the blood test, dirt from your hands may contaminate the blood of the patient and cause harm to the patient. Hence, it is important that you take precautions while you do the test:

- Wash your hands thoroughly with soap and water before you draw blood. You will be taught how to wash your hands properly during your training.
- Always use a fresh lancet for each test. Do not reuse lancets.
- Do not touch the sharp tip of the lancet before or during the process of drawing blood. If the lancet gets accidentally contaminated before it can be used, discard the lancet and use another.
- After the blood has been taken for the tests, place a clean cotton swab on the prick site and ask the patient to apply firm pressure on the swab for a few minutes.

To protect yourself from the patient's blood, take the following precautions:

- Do not touch the blood with your bare fingers at any time. Handle the lancet, swabs, slides and RDT test strips with care.
- Take care to ensure that you do not prick yourself accidentally with a used lancet.
- After the blood test are over, again wash your hands thoroughly with soap and water. This is the best way to prevent any harm to yourself from the patient's blood.
- Dispose of all used materials in the waste box as described earlier, and handle the waste box carefully.
5.1 Treatment

All fever cases diagnosed as malaria by either RDT or microscopy should be promptly given effective treatment. The medicine chosen will depend upon whether the patient has vivax malaria or falciparum malaria as diagnosed by the blood test.

**Fig 5.1: Fever Diagnosis and Treatment Algorithm**

Where microscopy result is available within 24 hours

Suspected malaria case

Take slide

- **Microscopy – P. vivax**
  - CQ 3 days + PQ 14 days

- **Microscopy – P. falciparum**
  - ACT 3 days + PQ Single dose

- **Microscopy – Negative**
  - No antimalarial treatment

**ACT** - Artemisinin-based Combination Therapy (Artesunate + Sulfadoxine-Pyrimethamine)

**CQ** - Chloroquine

**PQ** - Primaquine
Where microscopy result is not available within 24 hours

Suspected malaria case
- Do RDT
- Prepare blood slide for microscopy

RDT positive
- ACT + PQ Single dose
- Discard Slide

RDT Negative
- Send Blood slide to Lab, and await microscopy result
- If result is not likely to be available within 24 hrs, give CQ for 3 days and if after a few days result comes +ve for Pv then give PQ for 14 days.
- But if patients has severe symptoms then immediately refer the patient to the PHC.

Microscopy – P. vivax
CQ 3 days + PQ 14 days

Microscopy – P. falciparum
ACT 3 days + PQ Single dose

Microscopy – Negative
No antimalarial treatment

Note: PQ is contra-indicated in pregnancy and in children under 1 years.

5.1.1 Treatment of Falciparum Malaria

Diagnosis of Falciparum malaria may be made by the use of RDT or microscopic examination of the blood smear. It is imperative to start the treatment for falciparum malaria immediately on diagnosis. The treatment for falciparum malaria is as follows:

Artesunate (AS), available as 50 mg tablets are given for three days, and Sulfadoxine-Pyrimethamine (S-P) tablets, containing 500 mg Sulfadoxine and 25 mg pyrimethamine are given for one day, as shown in the dosage chart below. All tablets for a day should be taken together, swallowed with water. In addition, Primaquine (PQ Large) tablets should be given on the first day.
Table 5.1 Dosage Chart for Treatment of falciparum Malaria

<table>
<thead>
<tr>
<th>Age</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AS Tablet</td>
<td>SP Tablet</td>
<td>PQ (7.5 mg)</td>
</tr>
<tr>
<td>Less than 1 yr</td>
<td>½</td>
<td>¼</td>
<td>0</td>
</tr>
<tr>
<td>1-4 years</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5-8 years</td>
<td>2</td>
<td>1 ½</td>
<td>2</td>
</tr>
<tr>
<td>9-14 years</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>15 yrs or more*</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Primaquine prevents transmission of falciparum malaria to others by its ability to kill gametocytes. PQ tablets should be taken after a meal; not on an empty stomach. Children less than the age of one year and pregnant women should not be given Primaquine. As pregnant women having falciparum malaria require different medicines, they should be directed to go to the nearest PHC or hospital immediately, without delay.

5.1.2 Treatment of Vivax Malaria

Table 5.2 Dosage Chart for Treatment of vivax Malaria

<table>
<thead>
<tr>
<th>Age</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Days 4 to 14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CQ (2.5 mg)</td>
<td>PQ (2.5 mg)</td>
<td>CQ (2.5 mg)</td>
<td>CQ tablet</td>
</tr>
<tr>
<td>Less than 1 yr</td>
<td>½</td>
<td>0</td>
<td>½</td>
<td>¼</td>
</tr>
<tr>
<td>1-4 years</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>½</td>
</tr>
<tr>
<td>5-8 years</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9-14 years</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15 yrs or more*</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

5.1.3 Treatment of Mixed Infections

Table 5.3 Dosage Chart for Treatment of mixed (vivax and falciparum) Malaria

<table>
<thead>
<tr>
<th>Age</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Days 4-14</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AS Tablet</td>
<td>SP tablet</td>
<td>PQ (2.5 mg)</td>
<td>AS tablet</td>
</tr>
<tr>
<td></td>
<td>PQ (2.5 mg)</td>
<td>AS Tablet</td>
<td>PQ (2.5 mg)</td>
<td>AS Tablet</td>
</tr>
</tbody>
</table>
### 5.1.4 Use of paracetamol

Paracetamol tablets are available as part of the ASHA kit also in the health facilities. Paracetamol usually brings down fever from any cause within half an hour. However, paracetamol does not cure the disease that is causing the fever. So, its effect does not last long. The fever remains low for about 4-6 hours, and then the fever can rise again.

Paracetamol can be safely given at any age and even during pregnancy, in the dose shown in the dosage chart. In this dose, it can be given 3-4 times a day if needed. If the fever is not very high, and the patient is able to tolerate the fever, there is no need to give paracetamol.

**Table 5.4 Dosage chart for use of Paracetamol**

<table>
<thead>
<tr>
<th>Age</th>
<th>No. of Tablets of Paracetamol (500 mg tablets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 yr</td>
<td>¼</td>
</tr>
<tr>
<td>1-4 years</td>
<td>½</td>
</tr>
<tr>
<td>5-8 years</td>
<td>¾</td>
</tr>
<tr>
<td>9-14 years</td>
<td>1</td>
</tr>
<tr>
<td>15 yrs or more</td>
<td>1 or 2</td>
</tr>
</tbody>
</table>

### 5.2 Initiation of treatment and advice to the patient/caretaker

Once a suspected case is diagnosed positive by RDT or microscopy, treatment is started. The first dose is always taken in the presence of the health volunteer/worker. The blister pack with remaining tablets is given to the patient/caretaker to take home with clear instructions.

Caution: If the patient is a child under 5 years or pregnant, ask the patient to wait for 15 minutes after taking the first dose. If it is vomited within this period, let the patient rest for 15 minutes, then give the first dose again i.e. open a new blister-pack and discard what remains of the old. If the patient vomits the first dose again, it is considered a case of severe malaria, refer the patient immediate to the nearest Block PHC/ CHC/ Hospital.

Explain to the patient/caretaker
- That if the treatment is not completed as prescribed, the disease may manifest again with more serious features and more difficult to treat.
• To come back immediately, if there is no improvement after 24 hours, if the situation gets worse or the fever comes back.
• That regular use of a mosquito net (preferably insecticide treated net) is the best way to prevent malaria.

5.3 Recording of treatment

The result of RDT or slide should be entered by ASHA/ Health Worker/ MO in M-1 form. In case of Blood slide the date of receipt of result is to be entered. This will indicate the time lapse between the date of slide collection and receipt of results. If RDT has not been performed then simply mark a cross (X). Now depending upon the species, ASHA/ Health worker/ MO will decide the antimalarials to be administered. These will be entered in M-1 form. Suppose ACT has been selected then the entry will be made for the same. The date of starting and completing the treatment will be entered. During supervisory visits the time lag between slide collection or RDT and initiation of treatment should be identified.

5.4 Resistance to antimalarial drugs.

Resistance can be defined as either the ability of a parasite strain to survive and/or multiply despite the administration and absorption of a drug given in doses equal to or higher than those usually recommended, but within the limits of tolerance of the patient.

In the last two decades, an increasing proportion of *Plasmodium falciparum* infections is proving to be resistant to chloroquine in India. Drug resistance is declared in a study area, when the proportion of treatment failures exceeds 10% of all falciparum infections. In these areas the decision has been taken to treat Pf cases with the second line drug i.e., ACT instead of chloroquine,

5.4.1 Why does malaria parasite become resistant to anti-malarials?

Drug resistance is a complex phenomenon, where by genetic mutation, a parasite acquires the ability to resist, partly or fully, the effects of one or more anti-malarial drugs. When the resistant parasites are exposed to the drug, they multiply selectively. If parasites are resistant to the drug being used, the patient may not respond to treatment.

One of the commonest reasons for the development of drug resistance is that the parasites are exposed to insufficient amount of the drug due to

• Low prescription dosage
• Lesser amount of drug dispensed
• Incomplete treatment taken by the patient
• Drug vomited out
• Low absorption due to any reason, for example, diarrhoea.

In such cases, most of the sensitive parasites are killed by even these small doses, but resistant parasites survive, multiply and spread to other people by mosquitoes. The new patient then gets infection from the resistant malaria parasites and does not respond to the drug at all, or responds only partly. Meanwhile, the earlier patient may appear cured because most of the parasites were killed by the drug, and the symptoms abated.

5.4.2 Why is it difficult for parasites to develop resistance to ACT?

ACT contains three drugs: artesunate, sulphadoxine and pyrimethamine. Each drug acts on a different part of the parasite, in a different manner. It is very, very rare for three simultaneous genetic mutations to occur by chance to produce resistance to such diverse drugs. Resistance can be produced in multiple steps, one drug at a time, but this is expected to take many more years. At present, we do not expect resistance to develop to ACT. If resistance develops, it is expected to first develop against sulphadoxine or pyrimethamine, since they have been in use for a longer time. If this begins to happen, some other, newer drug will be used as a companion drug for artesunate, to which resistance has so far not been reported in most malarious areas of the world.

5.4.3 How can one suspect drug resistance in the field? What can one do when faced with treatment failure?

As mentioned above, when a patient fails to respond to treatment (symptoms fail to disappear, or they re-appear), one should think of the possibility of drug resistance. However, there may be many other causes of persistent symptoms:
• the diagnosis might be wrong (the patient had a positive test, but the symptoms were due to some other cause)
• the drug might not have been taken as expected (insufficient dosage was prescribed or swallowed), or may have been vomited out
• the drug was not absorbed in the gut (because of diarrhea, or other reasons), the drug may be of poor quality (past its date of expiry, or poorly stored, or of poor quality when supplied)
• the patient’s body might handle the drug abnormally (there are genetic differences in the metabolism of some rare individuals, which may cause the drug to be altered or eliminated quickly)
• the patient might have had a fresh reinfection, or in the case of vivax malaria, there might have been a relapse of the malaria.

In the absence of any of these conditions, if a patient has completed full treatment and is still having symptoms after 72 hours, treatment failure may be suspected.

The course of action when a patient has persistent symptoms is:
• Ask the patient and the family a series of questions to help rule out some of the causes listed above (Did the patient get the drug from an authentic, designated provider? Did the patient get the right amount of the drug? Was all of it swallowed as prescribed? Was the drug vomited out? How many days has it been since drug treatment was begun (if it is not yet 72 hours, one can wait)? Can you see the packing to check the expiry date? Are there symptoms of other obvious causes of fever? If the symptoms had disappeared and then reappeared, how long was the interval (if more than 15 days, it could be a fresh infection)?

• If it appears that the drug was not adequately taken or retained, a fresh course may be given at home unless the patient has symptoms of severe malaria. Take a fresh blood smear (take two, for checking in different laboratories, if need be), and ask the nearest health care provider to keep an eye on the patient.

• Refer any patient who has symptoms despite taking and retaining a full course of treatment, or who has developed symptoms of severe malaria.

5.5 Severe and complicated malaria

A case of uncomplicated malaria usually presents with fever, rigors, headache, bodyache, fatigue, anorexia and nausea.

Serious complications can arise in \textit{P.falciparum} infection. They may sometimes develop suddenly over a span of time as short as 12 -24 hours and may lead to death, if not treated promptly and adequately. Severe malaria is clinically characterized by confusion or drowsiness with extreme weakness (prostration). In addition, the following may develop:

• cerebral malaria with generalized convulsions
• pulmonary oedema
• severe anaemia
• renal failure
• hypoglycaemia
• metabolic acidosis
• circulatory collapse/shock
• spontaneous bleeding and laboratory evidence of DIC
• macroscopic haemoglobinuria
• hyperthermia
• hyperparasitaemia

In children, febrile convulsions, repeated vomiting and dehydration are common if the temperature is high due to any cause. Therefore, these symptoms are not necessarily indicative of severe malaria. However, children with such symptoms should be managed as severe malaria in routine program situations, and a diagnosis of malaria should be confirmed at the earliest.
In pregnancy, malaria, specially *P.falciparum* is a serious disease because with each bout of malaria, there is a reduction in haemoglobin and profound anaemia may develop rapidly. They are also at high risk of abortions or intrauterine growth retardation because sequestration of parasites in placenta restricts oxygen and nutrients flow to the fetus.

The management of severe malaria is possible in health facilities which are equipped with the following:

- Parenteral Antimalarials, antibiotics, anticonvulsants, antipyretics
- Intravenous infusion equipment and fluids
- Special nursing for patients in coma
- Facilities for blood transfusion
- Well equipped laboratory
- Oxygen respirator

Often these items are not available at the PHC level. Under such circumstances, the Medical Officer, PHC and paramedical staff should be able to administer emergency treatment and refer the case without delay to other institutions where such facilities are available.

A list of all health care facilities in the district where emergency care for severe malaria is available should be kept in PHCs and with Community Workers like ASHA. MO-PHC will maintain liaison with all these institutions. For timely referral of severe cases, transportation arrangements should be made with the use of untied funds available under NRHM.

**5.5.1 The role of peripheral workers**

The community comes in contact with ASHA and MPW (M&F) as a routine. They depend on these persons for advice and treatment of different diseases, malaria being one of them. Therefore, while training these workers the need to recognize a serious case of malaria should be emphasized. These workers should be conversant with the signs and symptoms of malaria and those which are likely to indicate serious complications.

Severe malaria may be suspected, if the patient does not get relief from symptoms of malaria within 24 hours, and/or headache/fever continues to increase. Such patients should be referred immediately to the nearest PHC/CHC/Hospital.

**5.5.2 Criteria for immediate referral to Primary Health Centre**

a) Persistence of fever after 24 hours of initial treatment.

b) Continuous vomiting and inability to retain oral drugs.

c) Headache continues to increase
d) Severe dehydration – dry, parched skin, sunken face
e) Too weak to walk in the absence of any other obvious reason
f) Change in sensorium e.g. confusion, drowsiness, blurring of vision, photophobia, disorientation
g) Convulsions or muscle twitchings
h) Bleeding and clotting disorders
i) Suspicion of severe anaemia
j) Jaundice
k) Hypothermia

5.6 Chemoprophylaxis
As chloroquine is no longer considered an effective treatment for falciparum malaria in India, it is no longer used for chemoprophylaxis. In pregnant women, there is no safe and effective alternative to chloroquine, which has been tested in India. Therefore, chemoprophylaxis is no longer recommended as a routine method of prevention in pregnancy.

5.6.1 Use of chemoprophylaxis is limited to following situations:
Short term travelers/tourists (less than 6 weeks) from non-malarious areas to malarious areas. Drug of choice is Doxycycline 100 mg daily in adults and 1.5 mg/kg bwt in children above 8 years; beginning 2 days before travel – 4 weeks after leaving a malarious area. Doxycycline is contraindicated in children under 8 years and pregnant women, in whom personal protection should be used.

In long term travelers where appropriate e.g. military & paramilitary troops on night patrol duty etc. in malarious areas, the decision of respective medical administrative authority is to be followed. Drug of choice in such cases is Mefloquine 250 mg weekly for adults and 5 mg/kg for children once a week; beginning 2 weeks before to 4 weeks after exposure.
6.1 Introduction

The role of vector control is to augment the impact of early diagnosis and prompt treatment of malaria cases. Integrated Vector Management (IVM) has been defined by WHO as a rational decision making process for the optimal use of resources for vector control. Vector control should be implemented:

- to reduce malaria to a low level in endemic areas
- to reduce malaria incidence where urgent malaria problems exist such as situations where previously malaria-free individuals, populations or communities are at high malaria risk
- to curtail the spread of malaria in areas where the parasite is resistant to antimalarial drugs
- to prevent epidemics
- preventing the reintroduction of malaria
- contributing to health, development and improvement in general living conditions

6.2 Vector Control Methods

Interventions using vector control methods are related to three major control measures:

Larval control

- Source reduction
- Larviciding
- Larvivorous fish

Reducing human-vector contact

- Insecticide-treated mosquito nets (ITN)
- Improved housing
- Repellents and mosquito coils

Adult mosquito control

- Indoor residual spraying (IRS)
- Insecticide treated nets
- Space spraying

General guidelines for the choice of measure to apply in a given situation may be summarized as under:

- In rural areas, high-risk populations must be protected by either IRS or bed nets
In such contexts, bed nets will be preferred in those areas where IRS is operationally difficult to execute satisfactorily. Over a period of time, the use of bed nets will be scaled up, and the use of IRS will correspondingly decrease to reduce reliance on insecticides.

It is recognized that epidemiological and entomological evidence, in addition to operational and local contexts would determine the choice of method to be used. Based of such considerations, guidelines will be refined from time to time.

6.3 Larval control

Larval control is indicated as the sole method of vector control only if a high proportion of the breeding sites within the vector’s flight range of the community to be protected can be located, accessed and managed. Larval control may be also undertaken to supplement or synergize the effects of other vector control interventions. Larval control requires a high coverage to be effective. Larval control is useful:

- in densely populated areas (like urban areas) with relatively few breeding places
- during very dry periods in endemic areas, when the breeding sites are very limited, definable and manageable
- in refugee camps or unorganized human settlements
- in development areas such as irrigation scheme and construction sites

6.3.1 Source reduction

The term source reduction refers to any measure that prevents the breeding of mosquitoes or eliminates their breeding sites. Environment management aims to modify the environment thereby causing reduction of vector breeding sources thus reducing human-vector contact and transmission risks.

If such measures bring about long lasting or permanent changes on land, water or vegetation, they are referred to as environmental modification (e.g. filling, drainage, planting water-loving trees such as eucalyptus trees in swampy areas and closing or covering breeding sites). When such measures have a temporary effect and need to be repeated, they are known as environmental manipulation (e.g. water-level fluctuation, intermittent irrigation, flushing, changing water salinity, clearing vegetation in streams and irrigation canals).

6.3.2 Larvivorous fish

One of the most successful and widely used biological control agent against mosquito larvae is the top water minnow or mosquito fish Gambusia affinis. Fish other than Gambusia which has received the most attention as a mosquito control method.
control agent is *Poecilia reticulata*, the common guppy. Fish have been extensively used for mosquito control in the urban malaria scheme. In recent years some of the states have extended the use of *Gambusia* and *Poecilia* to rural areas in suitable breeding places as a supplementary measure for vector control. All the states have also been advised to upscale the use of fish as biological control method in rural areas wherever feasible.

Fish should be preferably introduced in all unused wells in the rural and peri-urban areas before the high mosquito breeding season to maximize impact. Fresh water bodies in rural areas such as stagnant ponds, slow moving streams, quarry pits, large borrow pits, margins of ponds should be targetted apart from wells.

The hatchery for larvivorous fish can be established in natural water bodies or in a special hatchery. Fish hatcheries may be established at state, district headquarters, CHC/PHC and subcentre levels and other places so that adequate quantities of the fish are available for supply. The requirements of a hatchery are a constant supply of fresh water, vegetation such as hydrilla, vallisneria and salinity of water should not exceed 20 grams per litre. Hatchery should not be subjected to strong water current and should be protected from heavy rains and floods. The details of construction are beyond the scope of this manual.

For transportation, the fish are collected with help of netting, which is fitted on a circular iron ring of 60 to 90 cm diameter with a wooden handle. Fish are best transported in small containers of up to 40 litres, such as plastic buckets and jerry cans, or in strong plastic bags, half filled with water from the rearing pond. Fish should be released in the morning hours or in the evening.

Supervisors should check the following points at least once a month
- Functional status of mother hatcheries (both artificial and natural) at block and sub block levels
- Information regarding the water bodies where larvivorous fish have been released and where to be released
- Community participation and response

### 6.3.3 Larviciding

Larviciding includes the use of chemicals or biological agents or toxins to kill larvae and pupae. Larvicides are used in breeding sites that cannot be drained, filled or where other larval control methods are too expensive or impossible to use. Larviciding is indicated only for vectors which tend to breed in permanent or semipermanent water bodies that can be identified, and where the density of the human population to be protected is sufficiently high to justify the treatment. Thus, larviciding is restricted to urban areas, labour or refugee camps and development projects.
The residual effect of larvicides varies considerably depending on the water quality and type of the breeding place, but is relatively short for most larvicides. Most treatments must be repeated at fairly short cycles which may vary from 2-10 weeks. Larvicides of potential use are discussed below.

6.3.3.1 Petroleum oils

These are used for stagnant water bodies which are unsuitable for animal drinking and irrigation. Oils act mainly by forming a film on the water surface, thereby preventing larvae from breathing.

6.3.3.2 Common chemical larvicides

Temephos, which has a very low mammalian toxicity, has been the most widely used mosquito larvicide worldwide. It may be applied to water used for the irrigation of food crops, and has also been used for treating drinking-water. It is, however, toxic to fish. Fenthion is also commonly used when there is no risk of contamination of drinking water and food.

6.3.3.3 Insect growth regulators

These are chemical compounds that are highly toxic to mosquito larvae by preventing their development into adults. Their use has generally been limited by their high cost.

6.3.3.4 Larvicides of biological origin

*Bacillus thuringiensis israelensis* (*Bti*) produces toxins which are very effective in killing mosquito larvae after ingestion. It is harmless to other insects, fish, higher animals and humans at normal dosages and, at appropriate doses, may be suitable for use in water used for drinking or for the irrigation of food crops. Another bacterium, *B. sphaericus*, also produces a toxin. It has characteristics similar to those of *Bti* but is more effective in polluted water while *Bti* is more effective in clean water.

6.4 Reducing human-vector contact

6.4.1 Improved housing and location of settlements

Household and community actions to improve the quality of housing (design, construction, alteration including screening/mosquito proofing) and to deter mosquito entry and indoor resting can have more permanent effects than insecticide related control methods. Improved housing also improves the living condition and general health of the population. These are also relevant in planned settlements including development projects.
Poor housing is linked to higher risk, for example, incomplete houses with open walls, wide or unscreened eaves, houses with open windows and doors or without ceilings favour mosquito entry. Houses with damp walls and floors favour resting and increase malaria risk. House protection with screening of windows, eaves and doors is an effective method of reducing human-vector contact, if properly implemented and maintained. New settlements should be carefully planned, selecting the correct design, structure, construction material, and location in relation to breeding sites, to prevent malaria.

6.4.2 Repellents, mosquito coils and protective clothing

The use of repellents and protective clothing are useful for people who are outdoors during peak vector biting periods. Most repellents have a very short duration of effect (4-6 hours).

6.4.2.1 Repellents

Repellents are available as creams and lotions. These may be applied either directly on the skin or on clothes. They complement bed nets and house protection and can be used after dark before retiring under the mosquito net or by people who stay outdoors during part of the night. In epidemics, repellents have sometimes been distributed for malaria control, although their cost-effectiveness is doubtful.

6.4.2.2 Mosquito coils/Mats

Some insecticides kill or repel mosquitoes at a distance when vapourized with a heating device. Mosquito coils and mats are among the most popular and widely used insecticide vapourizers. Once lit, the coils smoulder, releasing the insecticide into the air at a steady rate for six to eight hours.

6.4.2.3 Protective clothing

Cloths that cover most of the body, i.e. long sleeve jackets and shirts, trousers and soaks can provide a certain level of personal protection from mosquito biting.

6.5 Choosing a measure of vector control for application in an area

Within the high-risk population, the populations that should be protected by particular vector control methods must be defined. In general, in rural areas, high-risk populations must be protected by either IRS or ITNs.

Given the difficulties in maintaining high coverage and quality of IRS, it is expected that over some years, ITNs will replace IRS in most areas, although the
latter method will still be needed to combat epidemics and in areas, where people cannot use ITNs bed nets eg. hot and humid climate.

Where IRS is currently used to protect part of the high risk population in a district, priority should be given to providing ITNs to those high-risk populations, which cannot be reached by IRS because of operational factors such as poor road access. In high-risk areas, pregnant women are usually highly vulnerable to malaria; they should be provided with an ITN at the first ante-natal consultation.

Like for IRS, it must always be planned in bed nets operations to achieve 100% coverage in each village. Although treated bed nets provide some protection to the individual using them, the full benefits are obtained only at high coverage levels.

Learning Unit 7. Indoor residual spraying (IRS)
7.1 Introduction

Malaria is transmitted by vectors that rest indoors and can be prevented or controlled by spraying the insides of houses with a residual insecticide. Before and more usually after biting, an endophilic mosquito rests on a wall, ceiling or in other dark areas inside the house. If the surfaces it rests on have been sprayed with residual insecticide, the mosquito may eventually pick up a lethal dose and be prevented from transmitting the parasite. The aim of residual spraying is to reduce the longevity of mosquitoes below the time it takes for the malaria sporozoites to develop and to reduce mosquito density.

Mosquitoes can develop resistance to a wide range of insecticides. It is important to know when a vector species develops resistance in order to decide change of insecticide.

IRS remains a valuable option for malaria control, when applied in the right circumstances. However, large-scale and continued application of insecticides is not sustainable because of the high costs (insecticide purchasing and operational costs), vector resistance to insecticides, and environmental concerns.

IRS is recommended only where:

- a majority of the vector population is endophilic
- the vector population is susceptible to the chosen insecticides
- a high percentage of the houses or structures in the operational area have adequate sprayable surfaces, and
- spraying is done correctly

7.2 Planning for IRS

Planning for IRS involves stratification and delineation of areas to be covered, with more precise definition of the operational boundaries and the frequencies and times of applications (i.e. macro-, micro-analysis of information to select targets). Issues to be considered in planning IRS are:

- transmission and burden of malaria are often focal and may vary with malaria endemicity and vector density even within a small area
- aggregate indicators such as annual parasite incidence rates should not be the only criterion for undertaking IRS. Micro-analysis (micro-stratification) is necessary for IRS targeting
- the size of operational areas is influenced by vector distribution, distance from important breeding sites, vectors’ flight range, demographic features, and distribution of malaria

The first decision to be made is whether IRS is a suitable intervention for the malaria problem in a particular area. The choice should be based on an evaluation of the results of previous vector control activities. To improve the
interpretation of existing records it is necessary to collect information on local vector bionomics and behaviour.

When residual spraying is used, a plan must ensure that the required coverage will be achieved for the specified period and that sufficient human and material resources will be available for this purpose.

IRS requires very high coverage in order to be effective. Spraying should be:

- total - all the dwellings are sprayed
- complete - cover all sprayable surfaces
- sufficient - uniform application of the required dose to all sprayable surfaces
- regular - repeated at regular intervals to ensure an effective residue is present during the transmission season

Meeting these standards requires a disciplined and competent organization with properly equipped and trained spraymen and efficient logistic support. A successful IRS programme should pay special attention to:

- planning required for the regular application of IRS
- the logistics of operational support, supplies, supervision and monitoring
- the responsibility of individuals and the community

House spraying requires the coordinated coverage of all sprayable surfaces at regular intervals (spraying cycle). The aim is to have a high coverage of all potential vector resting places with the effective dose of insecticide during the entire period when transmission is to be controlled.

7.3 Insecticides used for IRS

Several factors are required to be considered in the selection of an insecticide, including vector susceptibility, safety, cost, availability, residual effectiveness, and excito-repellency. For IRS, the insecticides in use are DDT 50% WP, Malathion 25% WP and synthetic Pyrethroids (WP). Synthetic Pyrethroids include Deltamethrin 2.5% WP, Cyfluthrin 10% WP, Lambdacyhalothrin 10% WP, Alphacypermethrin 5% WP and Bifenthrin 10% WP. Synthetic pyrethroid insecticides are also used for impregnation of bed nets.

The choice of insecticide must be based on sensitivity testing in all areas. In principle, susceptibility should be tested at least every second year in one locality in each district. If a district has different eco-types of malaria with different vectors, or certain areas, which are more affected by agricultural use of insecticides than others, additional localities should be monitored. Since pyrethroid is the only class of insecticides recommended for treating nets it should be used for IRS, only if there is no other choice.
7.4.1 DDT (Dichloro-diphenyl-trichloroethane)

In India, DDT may be used for vector control, provided that all the following conditions are met.

a) It is used only for indoor spraying for disease vector control
b) It is effective
c) The material is manufactured to the specifications issued by WHO
d) The necessary safety precautions are taken in its use and disposal.

Govt. of India has constituted a mandate Committee on DDT which reviews the use of DDT in public health and decides its quantity to be released for the vector borne diseases control programme every year. Even in areas where resistance to DDT has been demonstrated, some epidemiological impact of good spray operations is seen because of the excito-repellent action.

7.4.2 Malathion

Malathion 25% WP is used in areas with DDT resistance. If transmission takes place over the whole year, three rounds of spray with malathion are done as against two rounds of spray with DDT. Malathion is an organophosphorus compound, and exposure to large amounts can lead to poisoning. In case of organophosphorus (OP) poisoning, the patient should be transported immediately to a doctor. 2-4 mg of atropine should be given intravenously (for children 0.5 to 2 mg according to weight). Depending on symptoms, further doses of 2 mg should be given every 15 minutes for 2-12 hours in severe cases.

7.4.3 Synthetic Pyrethroids

Pyrethroids are synthetic chemical insecticides that act in a similar manner to pyrethrum, which is derived from chrysanthemum flowers. Pyrethroids are widely used for controlling various insects. They may be used as space sprays, residual sprays and in Ultra Low Volume fogging for mosquito control. They are also used for impregnation of bed nets for malaria control.

7.5 Insecticide formulations and dosages for IRS

Dosage is the amount of insecticide applied per unit area. It is normally expressed as grams or milligrams of active ingredient per square metre (g/m² or mg/m²) of sprayable surface. Doses vary considerably for the different insecticides. The dosage schedules for the commonly used insecticides under NVBDCP are given in the following table.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Insecticide</th>
<th>Requirement (in MT) for 1 million</th>
<th>Quantity of insecticide added to 10 L</th>
<th>Dosage per sq.m of active</th>
<th>Area (in sq.m) covered</th>
<th>Duration of Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>population for 2 rounds</td>
<td>water</td>
<td>ingredient by 10 L suspensio</td>
<td>effect (in weeks)</td>
<td></td>
<td></td>
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<td>----------------</td>
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<td>-------</td>
<td>-----------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1. DDT 50% WP</td>
<td>150.00</td>
<td>1 kg</td>
<td>1 gm</td>
<td>500</td>
<td>10 - 12</td>
<td></td>
</tr>
<tr>
<td>2. Malathion 25% WP</td>
<td>*900.00</td>
<td>2 kg</td>
<td>2 gm</td>
<td>250</td>
<td>06 - 08</td>
<td></td>
</tr>
<tr>
<td>3. Deltamethrin 2.5% WP</td>
<td>60.00</td>
<td>400 g</td>
<td>20 mg</td>
<td>500</td>
<td>10 - 12</td>
<td></td>
</tr>
<tr>
<td>4. Cyfluthrin 10% WP</td>
<td>18.75</td>
<td>125 g</td>
<td>25 mg</td>
<td>500</td>
<td>10 - 12</td>
<td></td>
</tr>
<tr>
<td>5. Lambda cyhalothrin 10% WP</td>
<td>18.75</td>
<td>125 g</td>
<td>25 mg</td>
<td>500</td>
<td>10 - 12</td>
<td></td>
</tr>
<tr>
<td>6. Alphacypermethrin 5% WP</td>
<td>37.50</td>
<td>250 g</td>
<td>25 mg</td>
<td>500</td>
<td>10 - 12</td>
<td></td>
</tr>
<tr>
<td>7. Bifenthrin 10% WP</td>
<td>18.75</td>
<td>125 g</td>
<td>25 mg</td>
<td>500</td>
<td>10 - 12</td>
<td></td>
</tr>
</tbody>
</table>

* In the case of Malathion, the requirement shown above, is for the three rounds

### 7.6 When to spray

The repetition of spraying operations at regular intervals is called the “spraying cycle”. It is the interval between repetitions, e.g. a six-month cycle. Each spraying of all sprayable houses in an area over a period of time is called a “spraying round”. The requirement that effective coverage be maintained during the entire transmission season implies that spraying of the whole area to be protected be completed before the beginning of that season (often the rainy season).

### 7.7 Preparation of houses before spraying

Correct spraying requires the careful preparation of the rooms to be sprayed. In particular, all food, cooking utensils, bedding and clothes must be protected from the insecticide by taking them outside the house before spraying starts; and all portable furniture and any pieces of furniture leaning against the walls should be removed so that the walls and all sides of all the pieces of furniture can be sprayed.

It is always necessary to check the working practises of spraymen in order to ensure that neither humans nor the environment are endangered. IRS requires the application of a uniform dose of insecticide to all the sprayable surfaces. This can best be achieved by means of compression sprayers.

### 7.8 Target surfaces

Generally, all the interior walls and ceilings are treated. In addition to permanent human dwellings, field huts where people sleep during the planting or harvesting season should be sprayed. The underside of furniture, back of the doors, outside eaves and porches must be treated. Human dwellings and mixed dwellings should be sprayed, but not cattle sheds, with a view to conserve insecticide, improve coverage of human dwellings and prevent diversion of mosquitoes from
cattle sheds to human dwellings. The residual effect of insecticides may be short on some surfaces, e.g. porous mud walls, oil painted wood and alkaline white wash, so these may require re-treatment after, for example, three months.

7.9 Spray Technique

The required quantity of insecticide should be issued to the squads each day by the supervisor after checking balance stocks available from previous day’s supplies. The insecticides used under the National Vector Borne Diseases Control Programme (NVBDCP) are available as wettable powders.

The preparation of the spray suspension is made just before the start of the spray operations every day. It is important that the suspension is made correctly so that the correct dosage is applied on the sprayed surfaces. The procedure for the preparation of the suspension is the same irrespective of the insecticide. However, the quantity of the insecticide used per 10 litres of water will depend on the insecticide used.

The required quantity of the insecticide is measured with a plastic mug and put inside a 15 litre bucket. A paste is made with a small quantity of water. The remainder of water is then poured slowly into the bucket and the insecticide water mixture is stirred vigorously to obtain a uniform suspension. The suspension is then poured into another bucket through a cloth sieve to remove any particulate matter that might clog the nozzle of the spray pump.

The barrel of the stirrup pump is put in the bucket containing the spray suspension. One man operates the pump and the other man sprays. In the case of compression sprayers, only one sprayer is required for the spray process. The spray lance should be kept 45 cms (18 inches) away from the wall surface. The swath should be parallel. Spray is applied in vertical swath of 53 cm (21 inches) wide. Successive swaths should overlap by 7.5 cm (3 inches). Spray is done from roof to floor, using downward motion, to complete one swath; then stepping sideways and spraying upwards from floor to roof. Do not let the spray drip to the floor. Spraying is done on inner surfaces including eaves and roofs.

The discharge rate should be 740 to 850 ml per minute. To obtain the above discharge rate, the pump man should give 20 to 26 strokes per minute with 10-15 cms plunger movement at a pressure of 10 PSI (0.7 kg/sq.cm) at the nozzle tip. Spraying into a bucket for one minute and measuring the quantity of the suspension in a graduated mug should check the correct discharge rate (740 to 850ml/minute). The nozzle tip should be discarded if the discharge rate exceeds 850 ml per minute.

If the spray stops due to a blockage in the nozzle, the nozzle cap should be unscrewed to remove the blockage and replaced with a new one. The blocked
nozzle should be put in a container with water for a few hours before the blockage is removed with a fine wire.

A good quality spray should lead to uniform deposit on walls and other sprayable surfaces. This is easy to verify for DDT and malathion sprays as the insecticide deposits are clearly visible. Deposits of synthetic pyrethroids are visible on wooden structures. The supervisor through physical verification should verify the quality and coverage of spray randomly.

It takes about 5 minutes to spray a house with an average surface area of 150 sq. metres. A daily summary of spray operations should be maintained by the field supervisor and verified by the health workers showing the areas covered, percentage room coverage and insecticide consumption in the tables as below:

7.10 Supervision

Supervision of spray operations is important to ensure that operations are carried out according to correct technical procedures, so that corrective action can be taken, to achieve the programme goals. Supervision is carried at all levels of programme implementation. It can be concurrent or consecutive. A stratified sample should be taken for consecutive supervision.

7.11 Protective measures

The safe use of insecticides for IRS requires a number of precautions. The removal or physical protection of all foodstuffs and cooking or eating utensils is imperative. In addition, inhabitants should be advised not to enter a sprayed room until the spray is dry, and to sweep all floors before allowing free entry into the house. This is particularly important for families with small children or indoor domestic animals that may have greater contact with the floor.

The use of protective devices and safe working practises is essential to avoid or reduce the contamination of spraymen, packers and mixers with the insecticide. In most spraying programmes in which insecticides of low acute toxicity (such as DDT) have been used, it is sufficient to wear overalls, broad-brimmed hats to cover the neck of the overalls, gloves and shoes or boots (the openings of which should be covered by the long trousers of the overalls). More toxic or more irritating insecticides require more elaborate protective devices such as light masks, goggles, visors and respirators.

Packers and mixers have a higher risk of contamination and should therefore use rubber gloves, masks or respirators and protect their eyes with a visor made of transparent plastic attached to the hat. Squad leaders must enforce safe practises and the appropriate use of protective devices. They must be familiar with early signs of intoxication and monitor members of their squad for any sign of poisoning.
Basic precautions to prevent unnecessary contamination include:

- Hands and face should be washed after filling each pump charge.
- Eating, drinking and smoking should be forbidden, except after washing and before starting to spray.
- Spraymen should not be exposed to insecticide for more than six hours each day.
- Overalls and hats should be washed daily, especially if they have been heavily contaminated.
- Spraymen must take a shower at the end of each day’s work.

Empty insecticide containers must be collected by the team supervisors and brought to the central storage area for proper disposal by qualified staff. It is also essential to follow the recommendations for the disposal of larger metal containers. Reuse of containers is always dangerous.

7.12 Acceptability and Community Participation

Indoor spraying requires the continued collaboration of the population, which may easily be eroded if people are not made continuously aware of the need for vector control. This is particularly important if some of the early benefits of spraying, such as the control of nuisance insects, are lost with time. It is therefore essential to maintain active contact with the community through an effective information, education and communication mechanism.

Involvement of Panchayats in successful IRS is essential. Panchayats/ village/ local bodies/ village heads/ Block Development Officers/ Mahila Mandals, religious groups etc., are to be informed about spray schedule at least a fortnight before the spray. This advance information must be given by Surveillance Workers/Malaria Inspectors/ District Malaria Officer so as to facilitate the villagers to extend full cooperation in getting the spray inside human dwellings with the objective of full coverage of targeted population.

7.13 Conclusion

The effectiveness of IRS depends on adherence to the specified criteria of the insecticide and application procedure, public acceptance of spraying, the use of well maintained equipment, adequately trained personnel and effective supervision. Timing of IRS is essential and must be based on epidemiological and transmission dynamics data. In general, spray operations should take place approximately one month before the start of the potential seasonal increase in incidence. In India, the peak transmission season(s) are usually determined by rainfall.

A systematic effort is needed to improve the quality of IRS. People’s perception of IRS should be changed through dialogue and flexible communication methods instead of enforcement. Safe insecticide management practices must be
incorporated in all chemical vector control operations. Systematic, supportive supervision should be based on standard operating procedures (SOPs). Replacement of stirrup pumps by more modern equipment is under consideration and subject to operational research.

Learning Unit 8. Insecticide Treated Bed Nets (ITNs)

8.1 Introduction
Insecticide treated bed nets can be either conventional ITNs or Long Lasting Impregnated Nets (LLINs). Conventional ITNs must be treated once or twice a year (depending on the duration of the transmission season). LLINs are mosquito nets, whose fibres have been impregnated with insecticide by a special technique, so that the insecticidal effect is maintained through about 20 washes, or as long as the net can withstand daily usage, i.e. 3-5 years.

Even when LLINs are available, re-treatment of nets, which have been distributed in the past or acquired by the population through commercial or social marketing may still be cost-effective. Re-treatment of ITNs should be done on priority in areas, where the community coverage of mosquito nets is at least 50% (where at least 50% of the population would answer yes to the question: “did you sleep under a mosquito net last night?” during the transmission season). When applying re-treatment of nets (rather than LLINs) in a village with at least 50% coverage of conventional mosquito nets, it is assumed that people will be encouraged by re-treatment operations and health education to acquire more nets, so that over time, coverage can reach 100%.

8.2 Long lasting insecticidal mosquito nets

Long lasting insecticidal mosquito nets (LLINs) are ready-to-use pre-treated mosquito nets, which require no re-treatment during their expected life span (4-5 years). They have several important advantages over conventional mosquito nets. These include eliminating the need to retreat the nets (one of the main obstacles to the use of insecticide-treated mosquito nets in many endemic countries), avoiding problems associated with the storage and handling of insecticides by nonprofessionals, and in the community, reducing insecticide use, and minimizing the environmental hazards caused by the release of insecticide into natural water bodies. The insecticide is slowly released from the polymer at the surface of the fibre. Residual efficacy is longer than that of conventionally treated nets. After washing, the biological efficacy is reduced initially, but diffusion of the insecticide from the inside of the yarn to the surface reinstalls it.

It is reiterated that Insecticide treated mosquito nets are now becoming one of the important methods for control of malaria vectors. Ordinary untreated mosquito nets provide limited physical barrier between mosquito and man; mosquitoes may still bite through the net or get inside the net following improper use. Mosquito nets treated with insecticides provide better and effective protection by keeping away mosquitoes as well as killing them.

In populations targeted for bed nets, coverage must be as close to 100% as possible and the delivery should be a free public service, as far as possible.
The type of bed nets that can be provided depends on the brands registered in India and the supply situation. NVBDCP will inform States about the expected effective life of the types of nets provided each year and any specific requirements.

8.3 Planning for Bed nets

Unless data to the contrary are available, it can be assumed that an average household has 5 members (2 adults and 3 children). It is then possible for one bed net to cover on average 2.5 persons (2 adults or 3 children or 1 adult plus 1-2 children). Thus, for a given village the number of bed nets is usually equal to the number of households multiplied by 2 or the total population divided by 2.5.

Generally, for a targeted village, the required number of nets should be distributed in one single operation. However, if nets are not in sufficient supply, it can be considered to distribute one net per household per year over a period of two years, i.e. with two rounds of distribution separated by 12 months. Timing of bed nets distribution is much less critical than the timing of IRS or re-treatment of nets. However, for educational as well as logistical reasons, distribution shortly before the start of the rainy season may be optimal.

In addition to distribution to targeted high-risk villages, bed nets should be given to pregnant women in high risk areas and to special groups such as children in tribal schools and hostels. These children should take the nets home with them during vacations.

Some of the questions that need to be considered when planning ITN strategy are:

- What are the behavioural patterns of the vectors? Are they mostly exophagic or endophagic?
- What are the peak biting periods, especially in relation to peoples' sleeping patterns?
- Are people outdoors (outside ITNs) at times when mosquitoes bite most?
- What are the night time movements and habits of people likely to affect exposure to vectors, including the time they go to bed? (This will vary with age, gender, and occupation).
- What are the attitudes of the people towards net use?
- Is there any preference for size, shape and colour of the bed nets?
- Who uses nets already? From where do they get the nets and at what costs?
- Are there seasonal variations in net use patterns?
- How do people react to insecticide used?
- What is the economic status of most people – this will affect net ownership, the ability to pay for insecticides and net (re)treatments?
Sustainability is more likely when communities pay for the nets and ideally for net retreatments. ITN service delivery (i.e. ensuring that people needing ITN have access to them) may be more promising and realistic where potential delivery systems and services already exist or when the potential exists to access these.

People often accept and use nets because they protect against nuisance mosquitoes including *Culex*, even though malaria control programmes promote insecticide treated mosquito nets with the objective of controlling malaria. It is therefore essential to bring about behavioural changes in the communities through continuous education and advertising the fact that the use of ITN protect against malaria, and to promote a sustained use even during seasons of low vector density.

8.4 Steps in Bed Net Programme

- Preparatory activities for distribution
- Impregnation of plain bed nets
- Distribution of bed nets
- Follow-up to ensure utilization
- Retreatment of plain bed nets
- Annual assessment and plan

8.4.1 Preparatory activities

Preparatory work should be done so that the nets are optimally utilized, including identification and recording of the eligible families and health educational activities in the community. Involvement of local community representatives, self help groups and NGOs should be encouraged to promote transparency of operations and optimal use by the community.

Health workers at health facilities and community health volunteers should provide key information during one-to-one encounters – especially when treating patients with malaria and during antenatal care and EPI attendance. Additionally, health talks can be given to small groups, especially those waiting for health services. Pre-recorded audio and video tapes may be used in this context and demonstrations, (e.g. of the correct way to hang bed nets), can be extremely useful. Existing materials, such as flipcharts, guidelines, leaflets and flash cards, should be adapted as necessary to support interpersonal communication within the context of an integrated curriculum for training health workers in malaria treatment and prevention. Informative print materials such as signs, posters and billboards are used to identify bed nets distribution points, including antenatal care facilities. The quantity of materials to be produced should be sufficient to cover the entire target population and will be determined by the number of outlets and communities.
The following activities should be completed by the health worker and Community health volunteers like ASHA prior to the distribution of the mosquito nets:

- Survey of the area
  - number of households
  - number of persons in each household
  - number of pregnant women and children under 5 years of age
  - number of mosquito nets in use
  - knowledge, attitude and practices

- Identification and involvement of
  - community representatives
  - self help groups
  - women’s organizations
  - NGOs

- Preparation of the list of beneficiaries

- Communication among the community for the regular and proper use of mosquito nets; for ensuring that especially pregnant women and young children sleep under a mosquito net; insecticide treatment of the bed nets and proper care of the bed nets

- Selection of site(s) and persons for insecticide treatment of the nets. Training of personnel and necessary items required for insecticide treatment should be arranged

8.4.2 Impregnation of Bednets

Impregnation of bednets supplied under the programme and community owned bednets is done at the community level through camps, by trained Health Workers, Community Volunteers, NGOs/ CBOs etc.

8.4.2.1 How to treat the net – 10 Easy Steps for Mass Treatment

- Mass treatment is done at fixed/designated sites.
- Insecticide treatment is recommended for synthetic nets (nylon, polyester), as treatment of cotton nets is not cost-effective and effect of insecticide is not long lasting.

| Step 1: Collect the necessary equipment |
The necessary equipment consists of: mosquito nets, insecticide, basin, measuring container, rubber gloves, soap.

- Make sure the net is washed/cleaned before treatment.
- Preferably, nets should be treated outdoors in the shade. If treatment is to be carried out indoors, a room with open windows should be used.
- Use basin, gloves that are not used for any other purpose.

<table>
<thead>
<tr>
<th>Step 2: Put on protective gloves before treating nets</th>
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<table>
<thead>
<tr>
<th>Step 3: Measure the correct amount of water</th>
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</table>

The amount of water needed depends on the net material. Regardless of the size and shape of net, the amount of water required for:

- One synthetic net (nylon, polyester) – ½ litre (if the net is very large, more water may be needed).

✓ If measuring container comes with insecticide, use it to measure water. Otherwise, use any measuring container, that is not used for food, drinks, medicines.

<table>
<thead>
<tr>
<th>Step 4: Measure the correct amount of insecticide</th>
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</table>

- The amount of insecticide or “dose” needed to treat a net depends on type of insecticide used. Follow instructions on the container, sachet, packet. Generally, 10-15 ml of insecticide is required to treat one net.

  ➢ [BIS Number of Liquid Synthetic Pyrethroid used for treatment of Bed Nets -

- Store leftover insecticide in its original container, in the dark and away from children.

| Step 5: Mix the water and insecticide thoroughly by gloved hands in basin |
Step 6: Treatment of nets

- **Always treat one net at a time.**
- Put the net in the basin containing water and insecticide.
- Soak the net long enough to ensure that all parts of the nets are impregnated.
- Take out the nets and allow excess liquid to drip back.

✓ Do not wring the treated net.

Step 7: Drying the nets

- *Let the net* dry flat in the shade on plastic sheets.*
- *Later,* the net can be hung up to finish drying in the shade.

Step 8: Disposal of leftover mixture of water and insecticide and insecticide containers

- Following treatment of all available nets, leftover mixture of water and insecticide, if any, may be used to treat curtains.
- Otherwise, dispose the liquid in the toilet or a hole away from habitation, animal shelters, drinking water sources, ponds, rivers, streams.
- Destroy empty insecticide containers, sachets, packets and/or bury in a hole away from habitation, animal shelters, drinking water sources, ponds, rivers, streams.

Step 9: Washing and cleaning of hands, equipments

- Wash equipments (basin, measuring container) with lots of water while wearing protective gloves.
- Wash gloves (if non-disposable ones are used]) with soap and lots of water, or dispose with insecticide containers.
- Wash hands with soap and lots of water.

Step 10: Washing and re-treatment of nets

- Washing removes insecticide from the net. So, wash the nets as seldom as possible and gently with soap and cold water and dry flat on plastic sheet in shade.

✓ Do not wash/rinse treated net in or near drinking water sources, ponds, lakes, rivers, streams. Dispose of water for washing/rinsing in the toilet or in a hole away from habitation, animal shelters, drinking water sources, ponds, rivers, streams
- Nets must be re-treated again after it has been washed three times. Or, at least once a year even if it is not washed, preferably just before the rainy season. Nets may be treated twice a year in areas that have a lot of mosquitoes all year long.

## Remember:
- Use the insecticide-treated net every night, all year round, even if mosquitoes are not seen/heard.
- Preferably, everyone should sleep under a treated mosquito net. Or, at least pregnant women and children under five years must sleep under treated net.
- Insecticides used for mosquito nets are not harmful to people, if used correctly. Direct skin contact with the insecticide on a still wet net may cause a tingling sensation on the skin. This is not harmful, even for small children.
- After treatment, the net may smell of insecticide. This will go away in a few days and is not harmful to people who sleep under the net.

### 8.4.2.2 Precautions

The insecticide should be kept out of the reach from children. To avoid risk of skin irritation, rubber gloves should be used during treatment. Care should be taken to prevent insecticide splashing on skin and eyes during treatment.

After impregnating the bednets, used containers must be cleaned, but never in rivers, streams or ponds as insecticides are toxic. Empty insecticide packets and contaminated containers must be destroyed to prevent their use for other purposes. They can be buried in a place, where they will not contaminate ground water. After that wash gloves and then hands and face thoroughly with soap and water.

Insecticide treated nets should not be washed in river, stream or ponds to avoid contamination of water sources.

- Mass treatment is done at fixed/designated sites.
- Insecticide treatment is recommended for synthetic nets (nylon, polyester), as treatment of cotton nets is not cost-effective and effect of insecticide is not long lasting.

### Some Useful Tips

- Use the insecticide-treated net every night, all year round, even if mosquitoes are not seen/heard.
- Insecticides used for mosquito nets are not harmful to people, if used correctly. Direct skin contact with the insecticide on a still wet net may
cause a tingling sensation on the skin. This is not harmful, even for small children.

- After treatment, the net may smell of insecticide. This will go away in a few days and is not harmful to people who sleep under the net.

Mosquito nets may be treated at the household (home treatment) or community (mass treatment) levels. Mass treatment by trained personnel may be provided by dipping centres and mobile teams.

### 8.4.3 Distribution of the nets

Efforts should be made to distribute insecticide impregnated bednets before the transmission season. While distributing bednets the following points should be considered:

- Generally, for a targeted village, the required number of nets should be distributed in one single operation.
- If sufficient nets are available, they can be delivered according to household size.
- Villagers are informed of the date and place of delivery in the village at least two weeks in advance. Each household is asked to send only one representative.
- The ITNs/ LLINs are given to the householders, who acknowledge receipt with a thumb-print or a signature.
- The delivery is done by volunteers, who are trained on the spot and supervised by MPHW.
- MPHW uses the opportunity to interview some people queuing, know people’s concerns regarding impregnated LLINs and answer them. He/she holds a talk, when the queue is at its largest, refers to the concerns he has heard and motivates people for correct use of the LLINs.
- After the session is over, MPHW plans follow-up activities with ASHA, AWW especially periodic home visits with one-to-one communication.

Transport of ITNs/ LLINs from district level storage to health facilities could be done, if needed, by the vehicles normally used to carry medicines, vaccines and other supplies within the district.

### 8.4.4 Post Distribution Activities

Periodic visits will be made to check net use. In communities which have not had a habit of using nets, frequent communication by local health workers after distribution is a most important measure. Arrangements will also be made for re-impregnation of conventional nets annually or bi-annually prior to the high transmission season(s).
One could categorize ITNs either as an adult mosquito control or reducing human-vector contact due to their combined effect. As a malaria prevention and control intervention, ITN programmes follow some basic concepts:

- used as a method of personal protection for high risk groups
- used for transmission control with a target of high coverage exceeding 80% of the entire population

Nets treated with pyrethroids give greater personal protection than untreated nets by irritating, repelling or killing mosquitoes before they can find a place to bite through the net. The presence of one ITN in a room may also partially protect individuals sleeping outside the net.

8.5 Social marketing of net

Social marketing of nets uses commercial marketing methods to create a demand for nets. Social marketing aims to meet a social need whereas traditional marketing aims to maximize profit. Social marketing could involve subsidy of nets and services.

When to apply - Special attention must be paid to net distribution systems and to periodic re-treatment of nets with insecticide. The activities required on the part of the malaria control programme will have to be adapted to the method of distribution when this vector control option is adopted. A more serious problem is that of establishing functional periodic re-treatment cycles based on the epidemiological needs, the residual effect of the formulations on different materials, and the habits of the population in washing their nets. From the epidemiological point of view, maximum protection is required during the transmission season or its peak, where transmission is perennial. When control programmes play an active role in the distribution of nets, whether free or subsidized, re-treatment is normally carried out at special events, such as National Anti Malaria Week (or day) or Health Day. These should be timed, if possible, to ensure the maximum coverage with freshly treated nets during the transmission season.

Even when distribution is left to commercial undertakings, official events to promote and demonstrate the use of insecticide-treated mosquito nets should be organized just before the start of the transmission season. The periodicity of re-treatment should be based on regional investigations that determine the actual residual effect of the insecticide under the conditions of use in the area concerned (climate, exposure to direct sun when used outdoors, washing habits, etc.) and on the seasonality of transmission. These studies should determine the best method of washing the nets, taking into account effects of local soaps, use of hot water, drying conditions, frequency of washing etc., which should be promoted by information, education and communication and during treatment or promotional events.
If nets are sold commercially and individuals are responsible for treatment, the users should be informed that if they wash their nets more often than recommended, they should also re-treat them more frequently. Wherever possible, insecticide treatment is better provided free of charge especially to the poor and vulnerable group.

When the risk of an epidemic is detected or even when an actual epidemic is detected at an early stage, it will be desirable to organize a re-treatment event in areas where coverage with treated nets is high, provided that this will not interfere with the implementation of emergency control measures that may be more effective.

8.6 Operational planning for IRS and ITNs/LLINs

Within the target populations for IRS and ITNs (the latter of which is divided in conventional ITN and LLIN target populations) it is necessary to identify the populations to be covered in the year under planning: the annual-plan target populations. These must be planned under resource constraints giving priority to those with the highest burden.

This planning is done by the District VBDC Officer in collaboration with the block and PHC Medical Officers concerned. The epidemiological data should be thoroughly analyzed in this process. A meeting of Medical Officers and MPHW supervisors (M) must be convened by CMHO/DMO for this purpose, normally in December. In some districts, it may be necessary to convene such meetings for each block or for clusters of blocks.

The population is obtained from the epidemiological data collected from each of the PHCs of the district. The PHC Medical Officers should bring this information to the meeting in the format given below for each sub-centre area including any high-risk population, and for each PHC area. During the meeting, the planning is reviewed, taking into consideration the epidemiological data and other factors. If needed, the PHC medical officers' plans are modified, and the agreed plans are then consolidated for each block and for the district.

8.7 Integrated Vector Management outcome and output targets

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Target (eligible) population (A)</th>
<th>Annual plan target population (B)</th>
<th>Coverage (%) at end of year (B/A)x100%</th>
<th>Output targets (nets to be treated/delivered/houses sprayed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed nets treatment once</td>
<td></td>
<td></td>
<td></td>
<td>Pre-transmission season</td>
</tr>
<tr>
<td>Bed nets</td>
<td></td>
<td></td>
<td></td>
<td># of nets to be treated once</td>
</tr>
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<td></td>
<td></td>
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<td></td>
<td>(population/2.5)</td>
</tr>
<tr>
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<td>Mid-transmission season</td>
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<tr>
<td></td>
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<td></td>
<td># of nets to be treated once</td>
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<td></td>
<td></td>
<td></td>
<td>(population/2.5)</td>
</tr>
<tr>
<td>treatment twice</td>
<td>treated twice (population/2.5)</td>
<td>treated twice (population/2.5)</td>
<td></td>
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<tr>
<td>----------------</td>
<td>---------------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Bed nets delivery</td>
<td># of bed nets to be delivered</td>
<td># of bed nets to be delivered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRS one round</td>
<td># of households to be sprayed once</td>
<td># of households to be sprayed once</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRS two rounds</td>
<td># of households to be sprayed twice</td>
<td># of households to be sprayed twice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IRS three rounds</td>
<td># of households to be sprayed thrice</td>
<td># of households to be sprayed thrice</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.8 Estimation of coverage based on operations records

- Conventional bed nets: Population protected is the one that could be protected by nets, which were treated as many times as foreseen in the calendar year (usually one or two times in a year, depending on seasonality), assuming that one correctly treated net can protect 2.5 persons. Thus, if the target population was 1000 and 100 nets were treated as many times as foreseen, then 250 persons were protected, and the coverage was 25% (of target population).

- Bed nets: Population protected is the one that could be protected by bed nets delivered, or, # of bed nets delivered and not yet expired x 2.5. For bed nets with a useful life of 5 years, the numerator includes all the nets delivered within the last 5 years.

- IRS: Population protected corresponds to the number of inhabitants living in houses fully sprayed as many times as foreseen in a year.

Those with the responsibility for logistics must be able to ensure adequate storage capacity and reliable transport at all levels, as well as precise timing. The planning of logistics must include a detailed budget for all transport and storage needs. Most importantly, logistic mechanisms must ensure adequate supervision and control of all operations and full accountability at every stage. It is recalled that bed nets are saleable; their diversion could have extremely deleterious effects on the programme at all levels.

8.9 Storage

**Table 8.1 Characteristics of bed nets relevant to logistics**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Multifilament polyester bed nets</th>
<th>Monofilament polyethylene</th>
</tr>
</thead>
</table>
### Table

<table>
<thead>
<tr>
<th></th>
<th>(deltamethrin-coated)</th>
<th>bed nets (permethrin-incorporated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight per LLIN</td>
<td>440 g</td>
<td>625 g</td>
</tr>
<tr>
<td>Bed nets per bale</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>Weight per bale</td>
<td>42 kg</td>
<td>29 kg</td>
</tr>
<tr>
<td>Volume per bale</td>
<td>0.1727–0.1894 m³</td>
<td>0.127 m³</td>
</tr>
<tr>
<td>Bed nets per 40-ft container</td>
<td>36 900</td>
<td>16 800</td>
</tr>
</tbody>
</table>

Bales of bed nets are well and securely packed; the nets are essentially non-perishable and are usually individually wrapped in sealed plastic bags. Nevertheless, it is important to ensure that warehouses are clean and dry. Shelf-life should be ascertained from the manufacturer.

Bales are relatively easy to handle, being light enough to be moved manually. The principal concern in their storage is thus one of volume rather than weight. The very large volumes involved make it critical that there is adequate storage capacity at all levels.

The tightly packed and tied bales can be stacked several layers high (up to a height of 5 m) without any damage to the bottom layers. In theory, 5.8 bales of polyester bed nets occupy a volume of 1 m³; in practice, 4 bales/m³ is a reasonable working figure. Thus, if a warehouse space is 10 m x 20 m with a storage height of 3 m, available volume is 600 m³, which would accommodate 600 x 4 = 2400 bales or a total of 240 000 polyester bed nets.

Monofilament polyethylene bed nets can be stored at 6 bales/m³, so that the same warehouse volume of 600 m³ would accommodate 3600 bales or 144 000 bed nets of this type.

Storage space can often be rented, but rental costs would then have to be weighed against the possibly greater cost of staggered delivery.

Stock management is relatively simple because bed nets are well packed and do not deteriorate physically. Stock management should be based on the “first in, first out” rule, making a methodical approach particularly important when containers are off-loaded in a large warehouse. Bales must be stacked in the same way throughout the operation, to create equal piles each identified by a bin card. Bales must be carefully counted by at least two individuals during off-loading of the containers; this provides a double-check of the quantities indicated on the bills of loading.

### 8.10 Logistics

Those with responsibility for logistics must be able to ensure adequate storage capacity and reliable transport at all levels, as well as precise timing. The
planning of logistics must include a detailed budget for all transport and storage needs. Most importantly, logistic mechanisms must ensure adequate _supervision_ and _control_ of all operations and full _accountability_ at every stage. It must be understood that LLINs are valuable as well as saleable. Hence their diversion could have disastrous effects on the programme if not prevented.
Learning Unit – 9 Prevention and Control of Malaria Outbreak/Epidemics

9.1 Definition of epidemic

An epidemic is defined as the unusual occurrence in a community or region, of a disease or health-related event, clearly in excess of expected occurrence. A malaria epidemic is suspected, if a large number of fever cases report to the OPD of PHCs/Dispensaries/Hospitals and majority of these fever cases are clinically suspected to be suffering from malaria.

An outbreak indicates an upsurge of cases in a small geographical area. eg. Village, sub-center or PHC.

9.2 Types of Malaria Epidemics

9.1.1 Climate-related

Malaria epidemics are usually seasonal, peaking during the rainy season and post monsoon period, which favour mosquitogenic conditions.

9.1.2 Population movement related

Population movements are an important cause of epidemics. Two main types may be distinguished:

(a) The ignition of an epidemic, usually in an area where economic development activity is taking place, by the arrival of individuals who are carriers of parasites.

(b) The arrival of a non-immune population group in a malaria-endemic area.

9.1.3 Health system related

In areas where control activities are disrupted, focal malaria outbreaks may occur.

9.2 How to Detect a Malaria Epidemic in early stage

The emergence of above early warning signals which may be obtained by inter-sectoral collaboration, with municipalities, agriculture, transport, the military, should lead to increased alert. This alert should be communicated to medical officers at PHC level requesting them to pay the greatest attention to weekly trends.
On the basis of early detection signals the MO PHC and DMO/ DVBDCO will suspect an impending outbreak/ epidemic. The most important signs to look out for are the Fever rate in OPD, Fever incidence in population and Malaria Incidence (compared with the same period previous year - without outbreak). Fever alert surveillance for malaria has been integrated with the Integrated Disease Surveillance Project (IDSP). Once a strong degree of suspicion is present the following steps need to be taken:

- Conduct a Rapid Fever Survey and collect blood slides/conduct RDT to find the Slide Positivity rate (SPR)/RDT positivity rate to assess the magnitude of disease
- Compare the trend of Malaria Incidence in the area during the year under investigation to preceding 2 years.
- Compare the SPR of the current month to the SPR of the same month of the previous year.
- Collect information on supportive factors like Climatic conditions, vulnerability, receptivity, vector density etc and try to determine the cause-effect relationship.

High positivity rate should also be confirmed by cross-checking of slides by an independent LT for ascertaining the quality of lab work.

| If an epidemic is predominantly of *P.vivax* infection, then it is likely that first round of insecticide had not been given in time as scheduled or coverage was poor. Further case management was not done for at least 2 or 3 months. |
| If an epidemic with *P.falciparum* predominance is seen with deaths of microscopically confirmed *P.falciparum* cases, then it is possible that both rounds of insecticidal spray were not given or coverage was extremely poor. Also, there may have been a problem in case management for at least 4 to 5 months. |

### 9.3 Prevention and Control of Malaria Epidemics

The aim of the NVBDCP is to prevent or identify epidemics/outbreaks in their incipient stages and to prevent them from progressing into full-blown epidemics. Prevention requires high level of preparedness and this is closely linked with the Integrated Disease Surveillance Project. The DMO/ DVBDCO/ CMO should ensure that all measures related to preparedness and control in case of a confirmation of epidemic/ outbreak, are in place in the district. Following are the key actions to be taken:

#### 9.3.1 Preparedness

The prerequisites for adequate preparedness are as follows:

#### 9.3.1.1 Rapid Response Team (RRT)
Rapid Response Team is constituted in collaboration with IDSP, to undertake urgent epidemiological investigations and provide technical guidance and logistic support. The RRT at state/provincial levels will comprise epidemiologists, entomologists and a laboratory specialist. At district levels it will comprise of the District Medical officer, District Malaria officer/District Malaria Consultant, non-health staff, local government staff.

9.3.1.2 Logistics

The CMO/DMO/ DVBDCO and the MO PHC will ensure availability of adequate buffer stock of reagents, slides, RDTs, drugs, insecticides spray equipment etc to take care of any excess requirement during outbreak/ epidemic situation in the district and PHC during the transmission season. A contingency plan should be in place for mobilization of resources. There should be a plan for management of severe cases; adequate number of beds should be made available in the health facilities. In case of an anticipated shortage, a plan to convert schools or Panchayat Ghars into wards should be in place.

9.3.2 Control of Malaria Epidemics

Once an abnormal situation is confirmed the RRT should reach the area immediately. Adequate resources, logistics and manpower should be mobilized. For the control of outbreaks/ epidemics following steps are to be taken:

9.3.2.1 Step 1: Delineation Of Affected Area – Rapid Survey

Surveys will be done with RDTs only, with microscopy only or with both, depending upon the local situation of ready availability. If it is expected to be a vivax malaria epidemic, the microscopy is necessary, as the presently available RDT kits detect P. falciparum only.

9.3.2.1.1 Rapid Fever Survey. During Rapid Fever Survey, every village in the suspected epidemic zone is covered and only fever cases or cases with history of fever are taken up and their blood smears are examined.

9.3.2.1.2 Mass Survey. As an alternative, in case the affected population is relatively small, a mass survey of the entire population shall be carried out in every village irrespective of fever status. Children must especially be included in the survey.

It is necessary to expand the area of survey centrifugally from the epicenter of the epidemic till areas with normal positivity rates are reached. Thus the size of the area involved in the epidemic zone is delineated.
To carry out the surveys, it is always advantageous to establish field laboratories by pooling Laboratory Technicians from adjoining PHCs, Districts, Zonal Office or State Headquarters laboratories and pool the peripheral staff from the PHC area to collect blood smears so as to cover the entire population as quickly as possible. This operation should be over in 7 to 10 days.

- Blood smears collected should be examined within 24 hours or RDT should be conducted.
- All groups should be covered, especially high risk population i.e. children, pregnant women and migrants.
- All positive cases should be given radical treatment at the recommended doses according to the slide or RDT result. If initial results indicate a positivity rate above 30% among fever cases (either blood smears or RDT), it may be considered to treat all fever cases as soon as blood sample has been collected.

9.3.2.2 Step 2 - Estimation Of Population Involved

The next step in the exercise is to calculate the population living in the epidemic areas. This can be done by taking the village-wise population from R-1 (Family Register) or the census population of the villages identified, whichever is readily available at the PHC.

9.3.2.3 Step 3 - Measures For Liquidation Of Foci

Having ascertained the population affected and the number of households in which measures to liquidate the epidemic are to be implemented, the anti-vector and anti-parasitic measures should be planned as under:

9.3.2.3.1 Space Spray. Every house in all the villages of the area affected by the epidemic should be covered. Indoor space spray should be carried out for 7 to 10 consecutive days or till the residual insecticidal spray in all houses of the locality is completed.

9.3.2.3.2 Indoor Residual Spray (IRS). The indoor residual insecticidal spraying operation should be started simultaneously with indoor space spray. The insecticide of choice will be the insecticide to which the local vector is susceptible according to best available information. All houses and mixed dwellings including sleeping rooms will be covered, but not exclusive cattle sheds

<table>
<thead>
<tr>
<th>Suspected malaria case</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Do RDT</td>
</tr>
<tr>
<td>- Prepare blood slide for microscopy</td>
</tr>
</tbody>
</table>
9.3.2.3.3 Entomological Investigations and other vector control measures

The Zonal Officer should depute the Zonal Entomological team to carry out vector density studies. They should report the findings to the RRT. They should point out the prolific breeding places requiring immediate action. If the epidemic is due to predominance of vector breeding in water storage tanks or in peri-domestic water collection, or in well delimited water bodies in arid areas, undertake anti-larval measures along with space spray and residual insecticidal spray. Later, entomological investigations may be carried out to update the susceptibility of the local vector(s).

The entire exercise should be completed in a period of 7 to 10 days and in any case not exceeding a fortnight (i.e. within one extrinsic incubation period) so that secondary cases are prevented.

9.3.2.4 Step 4 - Follow-up Action

To assess the impact of remedial measures, it is necessary to take the following follow-up actions:

- Continue close surveillance for one month (twice the incubation period) after the outbreak has been contained (as demonstrated by epidemiological indices).
- Strengthen case detection and treatment services at all levels in the vicinity by ensuring that laboratories are fully functional, the surveillance workers are deployed, the community volunteers are activated and supplies and logistics at all levels are ensured.
- Investigate cause of epidemic by an epidemiological investigation to find out whether the epidemic was due to for example:
  - Influx of migratory population which was not covered by routine control measures such as screening at the entry points and case management and surveillance in the project areas.
  - Breakdown of regular malaria control operations.
  - Natural calamities such as floods, heavy rains, drought with opening up of relief camps
  - Other relief measures with temporary shelters for migratory population
Learning Unit 10. Interaction and Coordination with other Departments

10.1 Introduction.

Coordination with other departments and their cooperation have a significant role to play in prevention and control of malaria. Therefore, it is important to interact with other departments to effectively implement antimalaria measures.

The different departments other than health which have a role in malaria control are Public works, Agriculture, Irrigation, Fisheries, Forestry, Environment, Education, Rural Development, Urban Affairs, Welfare, Information & Broadcasting, Communication, Transport, Railways and Defence etc. Their assistance will be solicited in our endeavour.

10.2 Interaction with Various Departments

10.2.1 Education Department. Health sector should work closely with the education sector to develop a health education component targeted at school children and devise and communicate appropriate health messages.

10.2.2 Public Works Department. The sector can contribute to source reduction by providing a safe dependable water supply with adequate drainage. In addition, through the adoption and enforcement of housing and building codes, a municipality may mandate the provision of utilities such as individual household piped water supplies or sewerage connections and rainwater (stormwater) run-off control for new housing developments or forbid open surface wells.

10.2.3 Agriculture Sector. Farmer Field School is a concept which can be used to teach the farmers regarding integrated pest and vector control. Agriculture fields can a potent source for anopheles breeding which requires vigilance and control measures.

10.2.4 Irrigation Department. It should be ensured that there are no breaches in lining of canals which may result in leakage and water collections that give rise to mosquito breeding.

10.2.5 Water Supply Department. Repair of leakages and coverage of overhead water tanks are some of the measures which can result in reduction of mosquito breeding.

10.2.6 Construction Works. Supervision of masonry tanks made during construction of buildings is required to be made regularly to ensure avoidance of mosquito breeding.
10.2.7 **Road Construction.** It will be ensured that excavations made ring the course of construction of roads do not become breeding grounds for mosquitoes.

10.2.8 **Railways and Industry.** Cooperation of Railways will be sought for visiting their yards and dumps to assess mosquitogenic conditions.

10.2.9 **Municipal Health Authorities.** Liaison with the municipality will be maintained for prevention of water logging, implementation of building bye laws concerning health, mosquito proof design of buildings and safe rain water harvesting.

10.2.10 **Fishery Department.** Assistance from the fishery department will be obtained for procurement of larvivorous fish and also for advice on construction and maintenance of hatcheries.

10.2.11 **Forest Department.** Assistance from the Forest department will be required in relation to control of forest- and forest fringe malaria.

10.2.12 **Panchayats.** Close cooperation with village Panchayats and Village Health and Sanitation Committee is required for effective implementation of malaria control activities.

10.2.13 **NGOs.** A good knowledge of the NGOs including Civil Society Organizations such as Community based organizations and Faith based organizations is important for optimal implementation of malaria control.

10.2.14 **Police.** A good liaison with the police is required to ensure that unforeseen difficulties are amiably resolved.

10.2.15 **Road Transport.** Constant liaison will be maintained with transport department for various programme related efforts including transportation of microscopy slides and the results, display of malaria slogans and messages etc.
Learning Unit 11. Community Participation and Behavior Change Communication (BCC)

11.1 Introduction. The NVBDCP envisages strong community participation and behavior change components in the malaria control program to meet the challenges in malaria control. This chapter deals with potential of simple approaches to optimize community participation and encourage correct community and family practices in dealing with malaria.

11.2 Interventions Available. Three interventions of proven value are now being introduced at large scale into the program, each of which has benefits tangible even to the lay person, and thus having high likelihood of acceptability and utilization:

11.2.1 Diagnosis. In the place of slide tests which involved delay in getting results, rapid diagnostic tests (RDT) for P. falciparum are now available. These tests can be conducted at the most peripheral levels by any one with simple training.

11.2.2 Treatment. In place of Chloroquine which was associated with treatment failure due to drug resistance, ACT is now available which is nearly 110% effective and is not associated with any major side effects.

11.2.3 Bed nets. In place of Insecticide impregnated Bednets which required periodic reimpregnation, soon we will have Long lasting bed nets which do not require reimpregnation, remaining effective even after 20-25 washes and lasting for 3-5 years.

A fourth component of the program having high acceptance potential is the establishment of trained ASHAs at village level, known as ASHAs

11.3 Scope for Communities to Participate

The malaria control program offers considerable scope for communities to participate in and own the program. An illustrative list of actions that communities can take is provided in the following tables.

11.3.1 Early Diagnosis and Treatment

<table>
<thead>
<tr>
<th>Community Support</th>
<th>Community Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Selection of appropriate volunteer</td>
<td>• Ensuring availability and accessibility of health care</td>
</tr>
<tr>
<td>• Spreading word about availability and reliability of RDT &amp; ACT</td>
<td>workers and volunteers</td>
</tr>
<tr>
<td>• Spreading word about need of early reporting for testing and treatment</td>
<td>• Alerting authorities about non-availability of health</td>
</tr>
<tr>
<td></td>
<td>care provider</td>
</tr>
</tbody>
</table>
of fever cases
- Facilitating quick transport of slides to the laboratory
- Alerting authorities about stock-outs of test kits or medicines
- Alerting local providers and higher authorities about outbreaks

11.3.2 Insecticide Residual Spray

<table>
<thead>
<tr>
<th>Community Support</th>
<th>Community Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Informing people about necessity of IRS</td>
<td></td>
</tr>
<tr>
<td>- Spreading the word about dates of spray</td>
<td></td>
</tr>
<tr>
<td>- Accompanying spray teams to convince residents about the necessity of IRS</td>
<td></td>
</tr>
<tr>
<td>- Monitoring whether spray operations are conducted as per norms and plans</td>
<td></td>
</tr>
<tr>
<td>- Providing feedback about perceived effectiveness of insecticide spray</td>
<td></td>
</tr>
</tbody>
</table>

11.3.3 Bednet Distribution and Reimpregnation

<table>
<thead>
<tr>
<th>Community Support</th>
<th>Community Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Deciding mode of bednet distribution in partnership with authorities</td>
<td></td>
</tr>
<tr>
<td>- Educating people about consistent and correct use of bed nets</td>
<td></td>
</tr>
<tr>
<td>- Determining convenient dates for impregnation work</td>
<td></td>
</tr>
<tr>
<td>- Providing labor for impregnation</td>
<td></td>
</tr>
<tr>
<td>- Ensuring equitable distribution in selected habitations</td>
<td></td>
</tr>
<tr>
<td>- Minimizing sale of bed nets by recipients</td>
<td></td>
</tr>
<tr>
<td>- Alerting authorities about malpractices</td>
<td></td>
</tr>
<tr>
<td>- Monitoring to ensure impregnation of bed nets as per planned schedule</td>
<td></td>
</tr>
<tr>
<td>- Providing feedback about perceived effectiveness of impregnated bed nets</td>
<td></td>
</tr>
</tbody>
</table>

11.3.4 Referral Services

<table>
<thead>
<tr>
<th>Community Support</th>
<th>Community Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Ensuring early transport of patients of severe malaria to the correct referral institution</td>
<td></td>
</tr>
<tr>
<td>- Helping the family avail of government schemes supporting costs of transportation and treatment (such as untied health funds available to CHC, PHC, Subcenters and Village Health Committees)</td>
<td></td>
</tr>
<tr>
<td>- Demanding and ensuring immediate care for cases of severe malaria at institutions</td>
<td></td>
</tr>
<tr>
<td>- Ensuring that untied funds at village and subcenter levels under NRHM are made available in a timely manner for poor families needing referral.</td>
<td></td>
</tr>
</tbody>
</table>
11.4 Behaviour Change Communication (BCC)

Behaviour Change Communication has been defined as a process of learning that empowers people to take rational and informed decisions through appropriate knowledge; inculcates necessary skills and optimism; facilitates, stimulates pertinent action through changed mindsets, modified behavior and reinforces the same.

- The analysis of values, beliefs and practices will tell us what the most relevant barriers to behavior change are, and what messages and approaches are likely to be most effective, for which segment of the potential audience.
- Simplicity, brevity, do-ability and relevance are the cornerstones of effective communication for behavior change.
- Interpersonal communication or counseling (IPC) is the preferred primary approach, particularly when introducing new practices that people are not familiar with, since this permits adaptation to a specific context and set of circumstances, but less intensive methods may suffice to sustain change.
- There are no guaranteed success formulas. Every intervention must be periodically evaluated for effect and reasons for success or failure. This should lead to minor or major revisions to strategies and plans. Thus, BCC is an evidence-based process involving continuous learning.

11.4.1 BCC in the malaria control program: the goals, and a practical approach

The communications strategy of the malaria control program is expected to serve the larger goal of the program: the reduction in morbidity and mortality from malaria. Specifically, effective communication is expected to lead to the following:

A. People and their representatives, particularly in high-burden districts, become aware of their entitlements under the malaria control program, and actively demand and monitor the realization of these entitlements.

B. Services offered by the program are widely and correctly utilized by affected families and communities.

11.4.2 Start with a basic plan

11.4.2.1 IPC for early diagnosis and treatment. As the new interventions roll out in high burden districts, a large number of volunteers and health workers will be trained in the use of RDT and ACT. A few basic “messages”, based on a best-guess list of potentially effective ones, should be included in these training modules, along with simple job-aids as necessary. Table 9.2 offers an illustrative list of such messages that each provider can use. In the initial weeks and months, the volunteers will need support through supervisory field visits of MPHW and MTS.
11.4.2.2 Simple mass communication before IRS and bed net distribution rounds: This can consist of recruitment of local folk media, NGOs and CBOs to explain the benefits and use of IRS and bed nets to communities.

11.4.2.3 Simple information on entitlements provided to people’s representatives and CBOs: Existing functional forums of the NRHM in the district (Missions and committees) can be addressed by the malaria program staff in the district, explaining the changes being brought into the malaria control program, and the expected benefits. Such communication should highlight the specifics of services such as habitation-level availability of diagnostic and treatment facilities, and the large-scale availability of bed nets, as well as the terms of availability (time, cost, quality, etc).

11.4.3 Information

Some of the information that may be delivered for BCC are given below

11.4.3.1 To community at large:
- Fever could be malaria
- Malaria can be dangerous, so should be treated in time
- I can test and tell you immediately if you have dangerous malaria or not
- I have free medicines which are very effective against dangerous malaria
- Come to me immediately when you have fever, anytime, without losing time
- Make sure you sleep under bed nets treated with insecticide. They keep malaria-causing mosquitoes away. It is particularly important to make sure that pregnant women and children sleep under the net

11.4.3.2 To patients (family) with a positive RDT:
- You have malaria of the dangerous kind
- Taking these tablets (ACT) in the correct dose will cure you
- Let me know if you still have fever after you complete treatment
- If you develop drowsiness, severe vomiting, or convulsions, you need to rush to (specified) hospital. You will get free admission and treatment there.

11.4.3.3 To patients with a negative RDT:
- You do not have malaria of dangerous kind, but it could still be malaria
- I will send your slide for testing and let you know the result in 2 days time
- You can take these tablets (paracetamol) to bring down the fever for a few hours after each dose, but these tablets cannot cure the cause of fever
- If you think you are getting worse, go and consult a doctor

11.4.3.4 While distributing bed nets:
- (Demonstrate how to put up a bed net indoors and outdoors)
- Wash this net as infrequently as possible, so that its effect lasts longer
- (ITN:) Bring this net back to me every six months, I will dip it in insecticide for you.
- (LLIN:) This is a special and expensive bed net. If you wash this infrequently (once every few months), the effect of the net will last … years. Selling this net is not allowed. You may be punished if caught.

**11.4.3.5 Before and during the IRS round:**
- Make sure you are available when the spray teams come on (date)
- The actual spraying will last only a few minutes
- The sprayed insecticide will not harm you, but it is best to wash utensils before use for cooking or eating
- Make sure all rooms are sprayed, especially rooms that you sleep in
  Do not wipe off the insecticide from the walls, or paint it over

**11.4.4 Assess after a reasonable period:**

About 3-6 months after the roll-out, even as early as during the first transmission season, a quick but formal, independent assessment of the program interventions can be carried out in multiple locations, to identify gaps in service availability, utilization and quality. If the results indicate the need for either closer community monitoring or for behavior change support, or both, a more in-depth study in a few sample districts should be conducted aimed at finding specific gaps and evolving specific messages and plans as part of comprehensive BCC and Community Participation strategy.

**11.4.5 Implement a comprehensive strategy:**

Within a year of the roll-out of interventions, and before the second transmission season, a comprehensive BCC and Community Participation plan can be put in place, and assessed again during the transmission season to iron out the remaining wrinkles. This plan will include the use of all channels of communication deemed to be appropriate, and accordingly, a larger budget.
Learning Unit 12. Monitoring & Evaluation

12.1 TERMINOLOGIES

12.1.1 Indicators

The data collected through the system of HMIS consists of volumes of information but this is useless, unless it is converted to relevant information through the application of intelligence. Indicators are therefore derived from this data and are used as variables that indicate a particular condition or situation. These indicators point towards programme performance in different areas and help identify problem areas to enable corrective action. Eg. Annual Parasite Incidence (API) is an indicator of disease burden and programme impact.

12.1.2 Surveillance

Surveillance has been defined as continuous scrutiny of the factors that determine the occurrence and distribution of disease. Surveillance is essential for effective control and prevention, and includes the collection, analysis, interpretation and dissemination of relevant information for action. In the programme Active Surveillance is carried out by Multi Purpose Worker through domiciliary visit while passive surveillance is carried out by the facilities like ASHAs, Subcentres, PHCs, Malaria Clinics etc where the patient come for diagnosis and treatment.

12.1.3 Monitoring

Monitoring encompasses on-going follow-up of the planned program activities / processes to examine whether the program is being implemented as planned and whether it is on track to reach stated goals.

12.1.4 Evaluation

Evaluation tells the program whether it has achieved stated goals in defined time-periods, and why it may have succeeded or failed.

12.1.5 Planning

Planning means the rational use of any and all relevant data to make the most effective possible utilization of program resources, based on the best understanding of cause-effect relationships, leading to the achievement of program goals. Planning is a necessary element of program management.

In the malaria program, routine planning is an annual feature at block, district and higher levels, usually undertaken by core malaria program staff. Typically, surveillance and other program monitoring data is used to plan insecticide spray
and outbreak preparedness planning, as well as planning for supplies and training related to case detection and management. In addition, supervisors at different levels within the health delivery system use weekly or monthly reports to investigate and manage outbreaks.

12.2 TYPES OF INDICATORS USED FOR SURVEILLANCE, MONITORING AND EVALUATION

12.2.1 Input Indicator

Input indicators tell us what the program is investing. Besides financial resources, the timely procurement of equipment and supplies, recruitments of staff and training provided to all functionaries are program inputs.

12.2.2 Process Indicator

Process indicators tell us whether specified program activities are happening as planned, in quantity and quality. Quality of training or the quality of supplies provided are processes that are often measured. Similarly, review and planning meetings held, plans made, supervisory visits made, contracts awarded, are all processes.

12.2.3 Output Indicator

Output indicators tell us what the immediate results of the inputs and processes were. Typically, what health workers do are outputs, which have come about as a result of many inputs and processes. The distribution of bed nets, the detection of fever cases, the achievement of insecticide spray targets are all outputs.

12.2.4 Outcome Indicator

Outcome indicators tell us whether the program interventions are having desired effects. Timely case management, the correct use of bed nets, reduction in vector density are all outcomes.

12.2.5 Impact Indicator

Impact indicators tell us whether we have reached. In the context of malaria, these are indicators of the burden of disease: the incidence of malaria, the incidence of severe malaria and the death rates from malaria.

The categorization of a given indicator as input or process or output is often subjective and a matter of convenience. This categorization should not be considered rigid, but should be utilized as a convenient framework to facilitate communication and planning within the program.
12.3 DEFINITIONS

Definitions in malaria control are to be applied to diseases management as well as selection criteria of Target Population for Vector control. Standard case definitions are required to bring about uniformity in management of cases as well as their reporting, which enables comparability within the same reporting unit over a period of time and across different reporting units. These case definitions are to be used at all levels in the programme.

12.3.1 Case Definitions

Table 12.1 provides case definitions for use in conjunction with indicators related to case detection and management.

**Table 12.1: Case definitions used in NVBDCP**

<table>
<thead>
<tr>
<th>Terms</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Suspected Malaria</td>
<td>A patient with fever in endemic area during transmission season, or who has recently visited an endemic area, without any other obvious cause of fever like:&lt;br&gt;1. Cough and other signs of respiratory infection&lt;br&gt;2. Running nose and other signs of cold&lt;br&gt;3. Diarrhoea&lt;br&gt;4. Pelvic inflammation indicated by severe low back ache, with or without vaginal discharge and urinary symptoms&lt;br&gt;5. Skin rash suggestive of eruptive illness&lt;br&gt;6. Burning micturition&lt;br&gt;7. Skin infections e.g. boils, abscess, infected wounds&lt;br&gt;8. Painful swelling of joints&lt;br&gt;9. Ear discharge&lt;br&gt;However, none of these symptoms exclude malaria with certainty. Only an experienced health functionary can exclude other “obvious causes of fever”.</td>
</tr>
<tr>
<td>2 Clinical Malaria</td>
<td>A patient with fever in endemic area during transmission season, or who has recently visited an endemic area, without any other obvious cause of fever will be considered as a case of clinical malaria if diagnosis cannot be established within 24 hours and</td>
</tr>
<tr>
<td>Terms</td>
<td>Definitions</td>
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<td>-------</td>
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</tr>
<tr>
<td></td>
<td>treated accordingly. For ruling out other causes of fever, the following should be looked for.</td>
</tr>
<tr>
<td></td>
<td>1. Cough and other signs of respiratory infection</td>
</tr>
<tr>
<td></td>
<td>2. Running nose and other signs of cold</td>
</tr>
<tr>
<td></td>
<td>3. Diarrhoea</td>
</tr>
<tr>
<td></td>
<td>4. Pelvic inflammation indicated by severe low back ache, with or without vaginal discharge and urinary symptoms</td>
</tr>
<tr>
<td></td>
<td>5. Skin rash suggestive of eruptive illness</td>
</tr>
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<td></td>
<td>6. Burning micturition</td>
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</tr>
<tr>
<td></td>
<td>9. Ear discharge</td>
</tr>
<tr>
<td></td>
<td>However, none of these symptoms exclude malaria with certainty. Only an experienced health functionary can exclude other “obvious causes of fever”.</td>
</tr>
<tr>
<td>3</td>
<td>Uncomplicated malaria (confirmed)</td>
</tr>
<tr>
<td></td>
<td>A patient with fever without any other obvious cause and diagnosis confirmed by microscopy showing asexual malaria parasites in the blood and/or positive rapid diagnostic test (RDT). These cases are recorded as either Pf or Pv; a case of mixed infection is recorded as Pf.</td>
</tr>
<tr>
<td>4</td>
<td>Severe malaria</td>
</tr>
<tr>
<td></td>
<td>A patient, who requires hospitalization for symptoms and/or signs of severe malaria with laboratory confirmation of diagnosis.</td>
</tr>
<tr>
<td></td>
<td>Severe malaria is clinically characterized by confusion or drowsiness with extreme weakness (prostration). In addition, the following may develop: cerebral malaria; generalized convulsions; pulmonary oedema; severe anaemia; renal failure; hypoglycaemia; metabolic acidosis; circulatory collapse/ shock; spontaneous bleeding; laboratory evidence of DIC; macroscopic haemoglobinuria; hyperthermia; hyperparasitaemia.</td>
</tr>
<tr>
<td>5</td>
<td>Malaria Death</td>
</tr>
<tr>
<td></td>
<td>Death of a patient with severe malaria, defined according to the above criteria. A death can only be medically certified as due to malaria if blood smear and/or RDT have been positive for P.falciparum.</td>
</tr>
</tbody>
</table>
Notes:
1. As per the revised Drug Policy (2008) all fever cases suspected for malaria should be investigated by microscopy or RDT. Therefore all efforts should be made to diagnose a suspected case. With the availability of RDTs in remote areas it is possible to confirm diagnosis in the remotest area. Only in exceptional circumstances where diagnosis by microscopy or RDK is not possible, cases with fever without any other obvious cause should be considered as ‘clinical malaria’ and treated.

2. Recent literature points to the possibility of severe malaria in patients with Plasmodium vivax. Although this is very rare, it should be recognized, so cases with only P. vivax may also be recorded as severe, if they fulfill the clinical criteria.

3. If the slide is positive for P. vivax only, death can only be certified as due to malaria by a tertiary level or higher facility, and a case report must be submitted to the State VBDCP for detailed death investigation.

12.3.2 Integrated Vector Control

As per the modified Plan of Operation (MPO) areas recording more than 2 API taking Sub-centre as unit are eligible for Indoor Residual Spray with appropriate insecticide. The Expert Committee (1995) further devised high risk criteria taking village as unit for identification of areas to be sprayed. However, for judicious use of resources and focussed intervention the Technical Advisory Committee (2002) on Malaria has rationalized the criteria for selection of villages for undertaking indoor residual spraying as indicated in the table below.

At present Indoor Residual Spray (IRS) and Bed-nets (ITNs/ LLINs) are the two key vector control interventions used in malaria control. Programme experience, drawn from years of operational problems encountered, has taught that IRS is a cost as well as labour intensive activity. In-depth review conducted by NIMR in the year 2006 also indicates the low coverage rates of IRS. Studies conducted across the globe in malaria endemic regions have shown that the average annual cost of bed-nets is much less than the cost of IRS; however, the use of bed nets requires continuous measures to improve community utilization. The NVBDCP has therefore taken the conscious decision to use either IRS or Bed-nets in a given area which means areas chosen for one method will usually not be covered by the second method of vector control. Therefore the criteria for selection of Target Populations for either method are laid in Table 12.2.

<table>
<thead>
<tr>
<th>Vector Method</th>
<th>Target Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRS</td>
<td>Areas with API more than 2 are classified as high risk. The Technical Advisory Committee on Malaria in its meeting held on 30.05.2002 has rationalized the criteria for undertaking indoor residual spraying. These criteria are as follows:</td>
</tr>
</tbody>
</table>
### Vector Control Method

<table>
<thead>
<tr>
<th><strong>Target Population</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• To spray on priority basis all areas taking sub-centre as a unit, with more than 5 API with suitable insecticides where ABER is 10% or more.</td>
</tr>
<tr>
<td>• To spray on priority basis with suitable insecticide all areas reporting more than 5% SPR (based on passive collection of blood slides), if the ABER is below 10%</td>
</tr>
<tr>
<td>• Due priority be accorded for spray if Pf proportion is more than 50%.</td>
</tr>
<tr>
<td>• To accord priority for IRS in areas with less than API 5 / SPR 5% in case of drug resistant foci, project areas with population migration and aggregation or other vulnerable factors including peri-cantonment area.</td>
</tr>
<tr>
<td>• To make provision for insecticidal spraying in epidemic situations.</td>
</tr>
<tr>
<td>• Rotation of insecticides may be done so as to prolong their effectiveness.</td>
</tr>
<tr>
<td>• Other parameters including entomological, ecological parameters etc., may also be considered while prioritizing areas for spraying.</td>
</tr>
</tbody>
</table>

The population must be defined in terms of its size, as well as the no of households. It should be estimates annually **village wise**. It should also be mapped at the beginning of each year.

<table>
<thead>
<tr>
<th><strong>Bed-nets (ITNs/ LLINs)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The High risk area requiring vector intervention and 1. difficult for conducting spray operations and supervision of spray activities (remote, inaccessible areas, hilly terrain, forested area etc.)</td>
</tr>
<tr>
<td>Or 2. areas where bednet usage and acceptability is high, would be covered with ITNs/ LLINs. The unit of area for coverage will be village.</td>
</tr>
</tbody>
</table>
12.4 MONITORING & EVALUATION SYSTEM

Monitoring at Block level will involve:

1. Routine Health Management Information System (HMIS)
2. Sentinel Surveillance of severe cases and deaths
3. Supportive Supervision

12.4.1 Routine Health Management Information System (HMIS)

The routine Health Management Information System (HMIS) is a series of recording and reporting formats to be maintained and transmitted by different tiers of the health care delivery system. The records and reports are to be maintained in such a way that high quality reliable data is generated from them.

12.4.1.1 Recording and Reporting

Integration of all Public Health Programmes and concerted service delivery under the umbrella of NRHM along with changing data and information needs of NVBDCP have prompted the revision and simplification of the HMIS. New interventions like RDTs, ACT, ITNs which have been recently introduced, are expensive inputs into the programme and it becomes important to closely monitor their utilization. Reporting on training activities, field visits, logistics & LQAS are to be done as part of Programme management Monitoring. For the purpose of routine recording and reporting the following M1 to M4 Formats and VC1 to VC 12 Formats and Programme Management Monitoring Report are used.

1. Case Detection and Management
   - M1 : Report of Surveillance by ASHA/ MPW/ Health facility
   - M2 : Laboratory Request for Slide Examination
   - M3 : Record of slide Examination in PHC Laboratory
   - M4-SC : Fortnightly Report of Cases From Subcentre
   - M4-PHC : Fortnightly Report of Cases From Subcentre

2. Integrated vector Control

3. Programme management Monitoring Report

An overview of these records and reports is provided below:

12.4.1.2 Case Detection and Management

The recording and reporting of cases is done in the following forms:

- M1 : Report of Surveillance by ASHA/ MPW/ Health facility
- M2 : Laboratory Request for Slide Examination
Forms M1, M2 M3 and M4 of the HMIS are concerned with case-management data and are given in **Annexure 1-4**.

1. **Fortnightly Report of Fever Cases by ASHA/ MPW/ Health facility (M1)**

This is the primary case record for all suspected malaria cases i.e it is actually a line list of all fever cases. This form is to be filled by any health facility/ worker which are directly involved in case detection and treatment. Therefore an ASHA or any other Community Volunteer, MPW and MO would maintain case record in this format. In M1, each row corresponds with one patient record. Serial No is filled in column 1 which is started fresh each month. Details of village, village code, name of fever case and Head of Family are entered in Col 2 to 5. Each village will be assigned a code for computer based data entry which is to be retained once and for all. In exceptional cases where a fever case is a visitor to the village, 991/ 992 is filled in the respective Col. Whether collection is during Active / Passive surveillance is filled as A or P in Col 6. For all purposes the ASHA/ CHV/ MO PHC will be passive agencies. Therefore in these cases the entry in Col 6 will be always P. it is only an MPW who can be involved in both types of collections. Fever cases coming to the MPW on their own will be entered as P while fever cases detected actively will be entered as A. Age is entered in Years/ months. Sex is to be entered as M for Male or F for Female. Duration of fever, date of RDT/ BSC, Slide No, sending and receipt of slides, result of examination of slides and RDTs, date of start of treatment, Nos of Tablets, referral and deaths if any are to be sequentially entered in the form.

Slide No is started fresh at the beginning of each year and continued over the subsequent months. Any positive test result is to be marked in red with a tick (√). Entries up to Col 13 are filled for all patients at the time of first contact. If the RDT is positive, the blood slide need not be sent for examination and therefore Col 14 to 18 are to skipped and are simply slashed (/). Treatment in such cases is started immediately for Pf. In cases where RDT is negative, blood slide is sent for examination and Col 14 to 18 are filled accordingly on receipt of results.

The lower part of the form consists of record of logistics. Opening balance at the beginning of the month, stock received, utilization and closing balance should be entered by ASHA or other service providers after physical verification of stocks. The ASHA/ CHV will fill M1 in duplicate and at the end of the fortnight, no later than a delay of 1 day will send 1 copy to the Subcentre. In the middle of M1, the MPW will enter the summary of cases. The MPW will compile M4-SC by compiling the M1 of all ASHAs and adding his/ her own M1.
2. Laboratory Request Form for Slide Examination (M2)

Fever cases are diagnosed using RDT and/or Blood Slide. In areas where RDTs are supplied, RDT and Blood slide are done at the same time. However, only if the RDT is negative, the blood slide is forwarded to Lab for further examination. Areas where RDTs are not supplied also rely on microscopy for diagnosis. M2 ie the Laboratory Request Form for Slide Examiantion, is filled in duplicate by ASHA/ DHV/ MPW whenever blood slides need to be sent to the Lab. In this form Col 1 to 7 are filled from M1 by ASHA/ CHV/ MPW. It is to be sent to PHC lab whenever required. Eg if 2 slides collected by an ASHA in a day, need o be examined, they are entered into M2 and sent to PHC Lab. The result of microscopy and feed back on smear quality are filled by the LT. All efforts should be made by LT to examine the slides on the day of receipt or the next day send the results back to ASHA/ CHV/ MPW on the same day as examination of blood slides. The results obtained are entered into M1 by ASHA/ CHV/ MPW.

3. Record of slide Examination in PHC Laboratory (M3)

M3 is the Subcentre wise record, of slides examined in the PHC Lab. Slides reach the lab from the ASHA/ CHV/ MPW of the SC area. Slides will also be collected and examined for fever cases referred from the PHC OPD. Therefore at the beginning of each year, the M3 register is divided into sections for different subcentres as well as PHC OPD. In each subcentre section Serial Nos are started fresh at the beginning of each year. Record of slides sent along with M2 is entered serially into M3. As soon as M2 is received Col 3 to 10 are entered from M2 followed by the date of receipt. The date on which the slides are examined is entered in Col 2. The slide results are entered in Col 13, 14. the remarks column can indicate the quality of smear and other information like reasons of delay in examination.

2. Monthly Report of Subcentre (M2) is a village-wise and provider-wise monthly consolidation of all M1 forms belonging to a subcenter area.

3. Monthly Report of PHC/ District/ State (M3) is a compilation of all M2 forms belonging to a PHC area, to be used for tracking trends in malaria indicators. Since it is desirable that village-wise surveillance data is available at district levels for monitoring and planning purposes, M2 is a crucial form.

In order to generate subcenter-level consolidation of M1 into form M2, MPW (M) or in his absence, the MPHWF(F), will consolidate M1 forms from all service providers in the subcenter area. These form should be filled in duplicate, one copy should be sent to MPW (M) and the second copy should be retained as record by the ASHA/ FTD/ MPW/ AWW. Through appropriate local arrangements, all M1 forms of the month from the subcenter area (M1 from each designated village level provider such as ASHA / AWW / FTD from all villages, as well as the M1 of both MPHWs of the subcenter) will reach the MPHW not later
than the 5\textsuperscript{th} of the subsequent month. The responsibility of timeliness and validity of reporting in the area of the PHC lies with the MO PHC.

The M2 prepared from these M1 forms will be dispatched no later than the 7\textsuperscript{th} of the month to the PHC. The form should be filled in duplicate, one copy should be sent to MO PHC and the second copy should be retained as record by the Subcentre.

The MO PHC will look over the compilation of all M2 reports from the PHC area into M3 which will be sent to DMO/ DVBDCO by the 10\textsuperscript{th} of the month. The responsibility of timeliness and validity of reporting in the area of the PHC lies with the MO PHC. At the district level all M3 reports will be compiled into a similar PHC wise format and sent to the state by 15\textsuperscript{th} of the month. The state will further compile these formats and send the report to NVBDCP no later than 21\textsuperscript{st} of the month.

12.4.1.2 Integrated Vector Control

The following formats are to be utilized for the purpose of reporting of Vector Control (Annexure 5, 6, 7, 8)

- VC 1 : Primary Record of IRS
- VC 1S : Wall stencil
- VC 2 : Monitoring Format for IRS - Subcentre
- VC 3 : Monitoring Format for IRS – Block PHC
- VC 5 :
- VC 6 :
- VC 7 :
- VC 8 :
- VC 9 :
- VC 10 :

1. Primary Record of IRS (VC 1): This record is to be maintained by the spray supervisor and is a village wise record of spray activities. One such record is maintained for each Village in each round. VC 1 is submitted to MPW within one week of completion of the respective IRS round as per schedule. The details on date of spray, Round, Spray squad No, Spray supervisor are to be entered in the left upper corner of the format. Similarly summary of the coverage is given in the right upper corner of the format. The lower part consists of the house wise log of room coverage.

2. Wall stencil (VC 1S): Wall stencil (VC 1S) is to be painted on each house after the house has been sprayed. Date, round, insecticide and squad No are painted as applicable. In SR/ TR the No of rooms sprayed/ Total no of rooms, is entered.
3. Monitoring Format for IRS – Subcentre (VC 2): The VC 3 format for monitoring IRS at the subcentre level is to be filled in by the MPW against the planned activities for each round of spray. The Columns 3, 4, 5, 6, 7 are to be filled from IRS Plan obtained from the Block MO. Columns 9 to 16 are to be filled by the MPW from the VC 1 submitted by the Spray Supervisor. As soon as the VC 1 of a village is received, the entire information is transferred into VC 2. It is to be filled in triplicate. When the spray is completed, VC 2 is submitted by the MPW to the Sector PHC in 2 copies, within 1 week of completion of spray as per IRS schedule in the Subcentre area. The MO Sector PHC will forward 1 copy to Block PHC and retains the second copy for office use. Col 17 to 19 is calculated by Sector/ Block PHC for % coverage as per the prescribed formula.

4. Monitoring Format for IRS (VC 3): The VC 2 formats for monitoring IRS at Subcentre are forwarded by Sector PHC to Block PHC which then compiles them into VC 3. VC 3 is nothing but a Sector PHC wise compilation of all subcentres and villages in the area of a Block PHC. This report is to be compiled and sent to district within 1 week of completion of IRS as per schedule, in the Block PHC.

The remaining Vector Control Formats are in the stage of finalization and will be elaborated later

12.4.1.3 Programme Management Monitoring Report (PMMR – Annexure X)

This report is to monitor progress made on different programme processes and other management issues. Update on Training status of the staff as well as the trainings conducted, field visits & reviews conducted and reviews undertaken as well as situation of logistics & stock outs are to be provided on a quarterly basis. The report has the following three sections:

Part A: Field visits & reviews, Epidemic response
Part B: Training Activity
Part C: Status of Logistics, and Diagnostic facilities

In future this report will also contain data collected by Malaria Technical supervisors through Lot Quality Assurance Sampling (LQAS) based surveys. The report is generated by the district at quarter ending and sent to the State by the 15th of the month following. The Quarterly State level report should be compiled and should reach NVBDCP by the 21st of the month following.

12.4.1.4 Monitoring Indicators
The data collected through the system of HMIS consists of volumes of information and is used to assess the performance of the programme at the local level. The monitoring indicators that are used in the programme are given in the **Table 12.3**: There is a complete range of indicators reflecting programme areas like case finding, disease burden, programme management etc. The requirement of indicators, at each level of health care delivery, is very specific. At the lower levels like PHCs and Districts indicators are utilized for local decision making while at the National level they are more relevant for policy making and assessing the overall progress. A complete list of levels of health care delivery along with the indicators to be determined at each level is laid down in **Table 12.4**. Each level of health care delivery is to be encouraged to analyse data based on these recommendations on a regular basis. Therefore when visiting a health facility the MTS should assess the situation based on the prescribed indicator at each level. Such an analysis should also be discussed with the health care providers at the respective level to objectively show to them the performance evaluation. Eg an ASHA can be shown that the No of Pf cases is rising or more No of deaths are being reported than the previous year. Therefore she should focus more on timely case detection. One of the suggestions given to her by MTS could be increased advocacy in the community to improve its health seeking behaviour for fever.
### Table 12.3: Monitoring Indicators used in malaria control

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Area</th>
<th>Indicator</th>
<th>Definition</th>
<th>Frequency</th>
<th>Source of Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong></td>
<td><strong>SURVEILLANCE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Surveillance/ case finding</td>
<td>No of Fever cases</td>
<td>Fever cases screened</td>
<td>Fortnightly/ Monthly/ Annual</td>
<td>M1, M4-SC, M4-PHC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No of Malaria cases</td>
<td>Malaria cases diagnosed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No of Pf cases</td>
<td>Pf cases diagnosed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Surveillance/ case finding</td>
<td>Monthly Blood Examination Rate (MBER)</td>
<td>Number of blood smears examined &amp; RDTs positive in a Month / Total Population X 100</td>
<td>Monthly</td>
<td>M4-SC, M4-PHC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(should be more than 1%of population during the transmission season)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Surveillance/ case finding</td>
<td>Annual Blood Examination Rate (ABER)</td>
<td>Number of blood smears examined &amp; RDTs positive in a year / Total Population X 100</td>
<td>Annual</td>
<td>M1, M4-SC, M4-PHC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(expected to be more than 10% of population)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disease burden &amp; impact</td>
<td>Annual Parasite Incidence (API)</td>
<td>Total No. of positive blood smears &amp; positive RDTs for malaria Parasite in a year / Total Population X 1000</td>
<td>Annual</td>
<td>M1, M4-SC, M4-PHC</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>--------</td>
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</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Disease burden &amp; impact</td>
<td>Annual Falciparum Incidence (AFI)</td>
<td>Total No. of blood smears &amp; RDTs positive for Pf malaria Parasite in a year / Total Population X 1000</td>
<td>Annual</td>
<td>M1, M4-SC, M4-PHC</td>
</tr>
<tr>
<td>6</td>
<td>Disease burden &amp; impact</td>
<td>Test Positivity rate (TPR) (Test = Slide+RDT) Is independent of surveillance activity, therefore a better indicator for impact assessment</td>
<td>Total No. of positive blood smears &amp; positive RDTs for malaria Parasite / Total No. of blood smears examined &amp; positive RDTs X100</td>
<td>Monthly, Cumulative for the year</td>
<td>M1, M4-SC, M4-PHC</td>
</tr>
<tr>
<td>7</td>
<td>Disease burden &amp; impact</td>
<td>Test falciparum Rate (TfR) It is independent of surveillance and indicates Pf preponderance</td>
<td>Total No. of blood smears &amp; RDTs found Positive for P.falciparum / Total No. of blood smears examined &amp; positive RDTs X 100</td>
<td>Monthly, Cumulative for the year</td>
<td>M1, M4-SC, M4-PHC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disease burden &amp; impact</td>
<td>Pf Percentage (Pf %) Indicates trends in proportion of cases due to Pf out of total cases</td>
<td>Total No. of blood smears &amp; RDTs found Positive for <em>P. falciparum</em> / Total No. of positive blood smears &amp; positive RDTs for malaria parasite X 100</td>
<td>Monthly, Cumulative for the year</td>
</tr>
<tr>
<td>---</td>
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<td>------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>B.</td>
<td>INPUT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Input</td>
<td></td>
<td>% of Staff in Place (ASHA, MPW, MTS, LT, DVBD Consultant)</td>
<td>No of Staff In place/ Total no of Staff Sanctioned X 100</td>
<td>Quarterly, Annual</td>
</tr>
<tr>
<td>2</td>
<td>Input</td>
<td></td>
<td>Nos of RDTs &amp; ACTs Planned versus Received &amp; used</td>
<td>Number of RDTs Planned to be used</td>
<td>Annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number of RDTs received</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number of RDTs used</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Number of ACTs Planned to be used</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number of ACTs received</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Number of ACTs used</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Number of functional microscopes</strong></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Input</td>
<td></td>
<td>% of spray Equipment in working condition</td>
<td>No of Spray Equipment in Working Condition/ No of Spray Equipment Present X 100</td>
<td>Annual (Pretransmission)</td>
</tr>
<tr>
<td>No</td>
<td>Process</td>
<td>Indicator</td>
<td>Description</td>
<td>Frequency</td>
<td>Source</td>
</tr>
<tr>
<td>----</td>
<td>---------</td>
<td>-----------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>4</td>
<td>Input</td>
<td>% of Spray squads engaged</td>
<td>No of Spray squads engaged / No of Spray squads required X 100</td>
<td>Annual</td>
<td>VC--</td>
</tr>
<tr>
<td></td>
<td>C. PROCESS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Process</td>
<td>BCC Activities</td>
<td>No of BCC/ IEC Activities eg meetings, rallies, exhibitions, street plays, miking, posters/ pamphlets, wall paintings, etc.</td>
<td>Quarterly, Annual</td>
<td>PMMR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of facilities (SC and PHC) / village level functionaries (ASHA, AWW) reporting stock-out of antimalarials during the fortnight</td>
<td>No of Health facilities reporting Stock outs in the previous fortnight/ No of Health facilities X 100</td>
<td>Fortnightly</td>
<td>M4-SC, M4-PHC</td>
</tr>
<tr>
<td>2</td>
<td>Process</td>
<td>% of MPHW/ASHA/other volunteers trained for use of RDT / ACT (calculated separately for different staff)</td>
<td>Total No of MPW/ ASHA/ other volunteers trained for use of RDTor ACT / Total No of MPW/ ASHA/ other volunteers X 100</td>
<td>Quarterly, Annual</td>
<td>PMMR</td>
</tr>
<tr>
<td>3</td>
<td>Process</td>
<td>% of Diagnostic facilities functional with</td>
<td>Total No of PHCs/ Pvt Sector Centres with functional microscopy X Total No of PHCs/</td>
<td>Quarterly, Annual</td>
<td>PMMR</td>
</tr>
<tr>
<td></td>
<td>Process</td>
<td>% of Diagnostic facilities functional with microscopy/RDT in the last reporting period</td>
<td>ASHA/ other community volunteers equipped with RDT ÷ Total ASHA / other community volunteers X 100</td>
<td>Quarterly, Annual</td>
<td>PMMR</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------</td>
<td>------</td>
</tr>
<tr>
<td>5</td>
<td>Output</td>
<td>Bed Nets treated</td>
<td>Number of nets treated</td>
<td>Quarterly, Annual</td>
<td>VC --</td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td>% of Eligible population Covered by ITN</td>
<td>No of Eligible population covered / Eligible population X 100</td>
<td>Quarterly, Annual</td>
<td>VC --</td>
</tr>
<tr>
<td></td>
<td>Output</td>
<td>% of Eligible villages with more than 80 % population Coverage with ITNs</td>
<td>No of Eligible villages with more than 80% coverage with ITNs / No of Eligible villages X 100</td>
<td>Quarterly, Annual</td>
<td>VC 2, VC 3</td>
</tr>
<tr>
<td>No.</td>
<td>Output</td>
<td>Average insecticide per bednet</td>
<td>Volume of Insecticide used for treatment of Bednets</td>
<td>Volume of insecticide used for bednet treatment/ No of bednets treated</td>
<td>Volume of insecticide used for IRS</td>
</tr>
<tr>
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</tr>
<tr>
<td>4</td>
<td>Output</td>
<td>Average insecticide per bednet</td>
<td>Volume of Insecticide used for treatment of Bednets</td>
<td>Volume of insecticide used for bednet treatment/ No of bednets treated</td>
<td>Volume of insecticide used for IRS</td>
</tr>
<tr>
<td>5</td>
<td>Outcome</td>
<td>IRS Coverage – Population (%)</td>
<td>Population covered with IRS / Total Eligible population X 100</td>
<td>Round wise during transmission season</td>
<td>VC 2, VC 3</td>
</tr>
<tr>
<td>6</td>
<td>Outcome</td>
<td>IRS Coverage – Rooms %</td>
<td>Rooms sprayed in houses Covered/ Total no of Rooms Targeted X 100</td>
<td>Round wise during transmission season</td>
<td>VC 2, VC 3</td>
</tr>
<tr>
<td>7</td>
<td>Outcome</td>
<td>% of fever cases who were tested for malaria by microscopy/ RDT with a positive test result for RDT and were started on treatment no later than the next day with ACT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outcome</td>
<td>% of households in which beneficiaries reported having slept under ITNs/LLINs previous night</td>
<td>Quarterly/half yearly</td>
<td>PMMR Based on LQAS</td>
<td></td>
</tr>
<tr>
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<td>--------------------------------------------------------------------------------------------</td>
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<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Outcome</td>
<td>% of households in which beneficiaries reported having slept under ITNs/LLINs previous night</td>
<td>Quarterly/half yearly</td>
<td>PMMR Based on LQAS</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Outcome</td>
<td>% of PHC sampled in which utilization of ITNs/LLINs was more than 80%</td>
<td>Quarterly/half yearly</td>
<td>PMMR Based on LQAS</td>
<td></td>
</tr>
<tr>
<td>Health Care Level</td>
<td>Programme Area</td>
<td>Indicator (Source of Indicator)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
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<td>------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Village - ASHA/ other Community Volunteer | Surveillance/ case finding | - No of Fever cases (M1)  
- No of Total Malaria cases (M1)  
- No of Pf cases (M1)  
- No of RDTs used (M1)  
- No of slides sent to laboratory (M1)  
- No of ACT Blister Packs used (M1) |
|                                   | Programme Management (Inputs, Process, Outputs) | - No of bednets impregnated |
| Subcentre – MPW (M)/ MPW(F)       | Surveillance/ case finding  | - No of Fever cases (M4-SC)  
- No of Malaria cases (M4-SC)  
- No of Pf cases (M4-SC) |
|                                   | Programme Management (Inputs, Process, Outputs) | - No of RDTs received & used (M4-SC)  
- No of ACT Blister Packs received & used (M4-SC)  
- Trained MPWs Present Yes/ No  
- No of ITNs/ LLINs distributed (VC -- ) |
| Outcome | - Bednets Treated (VC --)  
- % of Eligible population Covered by ITN(VC --) |
| --- | --- |
| PHC | - IRS Coverage – Population (%) (VC 2)  
- IRS Coverage – Rooms (%) (VC 2)  
- |
| Surveillance/ case finding | - Monthly Blood Examination Rate (ABER) (M4-PHC)  
- Annual Blood Examination Rate (ABER) (M4-PHC) |
| Disease Burden/ Impact | - No of Fever cases (M4-PHC)  
- No of Malaria cases (M4-PHC)  
- No of Pf cases (M4-PHC)  
- Annual Parasite Incidence (API) (M4-PHC)  
- Annual Falciparum Incidence (AFI) (M4-PHC)  
- Test Positivity rate (TPR) (M4-PHC)  
- Test falciparum Rate (TfR) (M4-PHC)  
- Pf Percentage (Pf %) (M4-PHC) |
| Programme Management (Inputs, Process & | - No of RDTs received & used (M4-PHC)  
- No of ACT Blister Packs received & used (M4-PHC)  
- % of MPHW/ASHA/other volunteers trained for use of RDT / ACT |
| Outputs) | **(PMMR)**  
|---|---  
|  - % of Diagnostic facilities functional with microscopy/RDT in the last reporting period **(PMMR)**  
|  - % of spray Equipment in working condition (VC --)  
|  - % of spray squads engaged (VC --)  
|  - Insecticide use (VC 2, VC 3)  
|  - No of ITNs/ LLINs distributed (VC --)  
|  - % of Eligible population Covered by ITN **(VC 2, VC 3)**  
|  - % of Eligible villages with more than 80 % population Coverage with ITNs - Bednets Treated (VC --) - No of BCC Activities  |
| Outcome | **(PMMR)**  
|---|---  
|  - IRS Coverage – Population (%) **(VC 2, VC 3)**  
|  - IRS Coverage – Rooms (%) **(VC 2, VC 3)**  
|  - % of house holds in which beneficiaries reported having slept under ITNs/ LLINs previous night **(PMMR)**  
|  - % of fever cases who were tested for malaria by microscopy/ RDT with a positive test result for RDT and were started on treatment no later than the next day with ACT **(PMMR)** |
12.4.2 Sentinel surveillance

There are three kinds of sentinel surveillance envisaged under the malaria control program, each serving a different purpose:

- Monitoring drug sensitivity of malarial parasites
- Monitoring effectiveness of insecticides used, including for IRS and bed nets
- Monitoring the incidence and outcomes of severe and complicated malaria

12.4.2.1 Set-up and functioning of Sentinel Sites

A minimum of two sentinel sites will be established in each district. As this is a new activity and quality is paramount, districts should normally start with only two sites and consider expansion later. Hospitals with large OPDs and inpatient case loads should be chosen. Therefore, the district hospital should automatically qualify as one such site. Other sites are selected amongst the PHCs/CHCs/private/faith-based hospitals. It is desirable to have sentinel sites among the private/faith-based sector as many patients seek care there and this data is most often not reflected in the HMIS. Districts which have Medical Colleges should establish a site in these tertiary care centers, if they are known to handle a sizeable load of malaria cases.

The Sentinel Sites should be adequately staffed and Medical Officers and laboratory technicians (LTs) should be trained. A nodal Medical Officer (SSMO) should be in charge of all activities regarding malaria in the sentinel sites. In each out-patient unit, a separate register for fever cases without any other obvious cause (suspected malaria) should be maintained. Information on in-patients is entered on the same form to avoid double-counting and difficulties in patient identification. There should be a laboratory with a qualified laboratory technician in charge, where malaria microscopy is quality controlled. At each sentinel site, an LT (SSLT) working under the supervision of the SSMO will be responsible for the quality of the malaria laboratory results and for data compilation.

Table 12.5: Indicators for malaria sentinel surveillance

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Indicator</th>
<th>Description</th>
<th>Breakdown (with percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of out-patient cases of malaria</td>
<td>Self-evident</td>
<td>Clinical/confirmed, &lt;5/5+, M/F, PV/PF, sub-centre area</td>
</tr>
<tr>
<td>2</td>
<td>Number of in-patient cases of malaria</td>
<td>Self-evident</td>
<td>Clinical/confirmed, &lt;5/5+, M/F, PV/PF, sub-centre area</td>
</tr>
<tr>
<td>S. No.</td>
<td>Indicator</td>
<td>Description</td>
<td>Breakdown (with percentages)</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>3</td>
<td>Number of cases of severe malaria</td>
<td>Self-evident</td>
<td>Clinical/confirmed, &lt;5/5+, M/F, sub-centre area</td>
</tr>
<tr>
<td>4</td>
<td>Number of malaria deaths</td>
<td>Self-evident</td>
<td>Clinical/confirmed, &lt;5/5+, M/F, sub-centre area</td>
</tr>
<tr>
<td>5</td>
<td>% OPD cases attributed to malaria</td>
<td>Total no of cases of OPD malaria/Total OPD X 100</td>
<td>&lt;5/5+</td>
</tr>
<tr>
<td>6</td>
<td>% in-patient cases attributed to malaria</td>
<td>Total no of cases of in-patient malaria/Total OPD X 100</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Proportional mortality due to malaria</td>
<td>Total no of deaths due to malaria in hospital admissions / Total no of deaths in hospital admissions X 100</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Case fatality rate of falciparum malaria</td>
<td>Total no of confirmed malaria deaths/total no. of falciparum malaria cases</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Case fatality rate of confirmed severe malaria</td>
<td>Total no of confirmed malaria deaths/total no. of confirmed severe malaria cases</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Case fatality rate of all severe malaria</td>
<td>Total no of malaria deaths (confirmed + clinical)/total no. of severe malaria cases (confirmed + clinical)</td>
<td></td>
</tr>
</tbody>
</table>

### 12.4.2.2 The interpretation of Indicators

The main disease incidence indicators listed in Table 12.3 can be calculated from the data available from M4 for virtually any level, from village to national level. If all suspected cases of malaria in the country (or district or village) are actually captured in M1 and consolidated correctly into M4, the resultant indicator values for API, TPR etc., will not be estimates based on samples but actual incidence values based on universal data. In practice, the capture is always less than universal, and thus an estimate. All indicators should be assessed for an increase or decrease from the previous year. When the current year is being considered the corresponding period of the previous year is used for comparison. API of More than 5%, SPR of more than 5%, Pf% more than 50% should always
raise an alarm. These indicators are also used to identify high risk areas and identify areas to be focused on priority.

Some of the common ways in which appropriately disaggregated surveillance data can be meaningfully interpreted is described in Table 12.6.

**Table 12.7 Interpretation of trends in malaria surveillance indices**

<table>
<thead>
<tr>
<th>Indicator trends</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases in one week in a village more than twice the number of cases in the previous week</td>
<td>Outbreak. The provider should alert the PHC staff immediately.</td>
</tr>
<tr>
<td>Sudden increase in suspected malaria cases and number of tests conducted, but no change in SPR</td>
<td>Not malaria. Investigate outbreak for other causes of communicable disease.</td>
</tr>
<tr>
<td>Increase in SPR, but only in adults, mostly males, no increase in cases or tests in children.</td>
<td>Provider is missing children OR Not local transmission. Investigate for migrant adults and their migration history.</td>
</tr>
<tr>
<td>Increase in cases of severe malaria reported from a sentinel institutions, most cases belong to a specific block or PHC</td>
<td>Outbreak, which should have been detected in routine surveillance. Hence, probable failure of case detection and management in the identified area.</td>
</tr>
<tr>
<td>Increase in cases of severe malaria reported from one sentinel institution, no geographical trends in the data</td>
<td>Recently improved recording and reporting at sentinel institution OR Geographic data available at the sentinel institution is faulty or incomplete OR General improvement in referrals of severe cases from field areas all over (unlikely) OR General failure of the malaria control program (unlikely)</td>
</tr>
</tbody>
</table>

**12.4.3 Supportive Supervision:**

Supportive supervision is a continuous process which aims to increase the knowledge, develop the skills, improve the attitude and enhance the motivation of the health care functionaries. Supportive supervision is not an instrument for fault finding but aids in identification of problems, solving them and improving performance. It provides an opportunity to the supervisor and health workers to identify and address weaknesses together, thus preventing poor practices from becoming routine. Progression from traditional to supportive supervision may require changes in attitudes, practices and perceptions on the part of supervisors.
The protocol of supervision for MTS is given in detail in the roles of MTS given in Appendix 1

12.4.3.1 How To Establish Supportive Supervision

A. Improve performance

- Use a protocol/standard operating procedure including a supervisory checklist for each type of unit supervised. (Eg. Checklist of MTS at Annexure Y)
- Conduct supportive supervisory visits also within health care facilities.
- Provide staff with updates on policies or new recommended practices. Undertake on-the-job training see above supported by guidelines, manuals, visual aids.
- Plan supervision schedule in advance and communicate it to all those, who need to know. Lesser performing health facilities should receive extra, or more lengthy visits, so make sure that the initially planned schedule has slack time for this.
- Plan these visits as much as possible, when it is possible to observe the staff and interview patients. Talk to patients about the quality of services, preferably away from the health facility.
- Plan to spend sufficient time (from several hours, to a full day or more) to conduct the supervisory visit to each unit. Rushed visit with no time for dialogue are inefficient.
- Follow up on recommendations made during previous visits. Discuss progress with the health facility.
- Check the stocks and the condition of equipment. Compare stocks with records. Are storage conditions correct? If not, help find solutions. Carry materials, and supplies for the health facility according to requests made or needs identified at previous visit.
- Review health facility records and provide feedback to the staff as well as MO in charge.
- Analyse programme indicators for the health facility to make the performance objective and measurable.
- Involve the community in the evaluation process. Ask community members how they are treated when they visit the facility. Talk to community leaders during the visit to get their feedback and identify jointly, what the community can do.
- Find out, if the relationship between community and health workers is good; if not, find out what is wrong and remedy the situation.
- Discuss strengths and weaknesses, and actions to be taken (by whom and by when).
- Identify gaps and solve problems in positive ways.
• Praise health workers in public for good performance and for practices that meet quality. Correct performance only through person-to-person contacts.
• Work with other health programmes to coordinate supervisory activities in a spirit of mutual support.
• Schedule a return visit before leaving the site.

B. Maintain and enhance motivation

• Give praise and recognition to health workers for what they are doing right.
• Act on feedback from the health workers, health workers will feel valued that they have an impact. Show that you trust them (as much as you actually do)
• Attend monthly meetings in all health facilities within the Block. This provides an opportunity for health workers to learn new approaches and strategies used in different health facilities and to receive continuing education. It can also be a forum to acknowledge their achievements.

C. Build sustainability

• Collect data on positive results gained from supportive supervision, such improved performance of health workers, improved coverage of IRS, better treatment etc.
• Develop a team approach involving Health supervisors & MPWs to increase supportive supervision at the health facility and make it a routine procedure, with or without frequent visits from the central or district level.