RAMA UNIVERSITY

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FACULTY OF NURSING

EPIDEMIOLOGY OF MALARIA

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MALARIA

- **Malaria is a protozoal disease caused by infection with parasites of the genus PLASMODIUM and transmitted to man by certain species of infected female ANOPHELINE mosquito.**

- **A typical attack comprises three distinct stages:**
- **1. COLD STAGE.**
- **2. HOT STAGE.**
- **3. SWEATING STAGE.**

- **The clinical features of malaria vary from mild to severe, and complicated according o the species of parasite present, immunological status of the patient, intensity of infection and presence of concomitant conditions (malnutrition & other disease).**

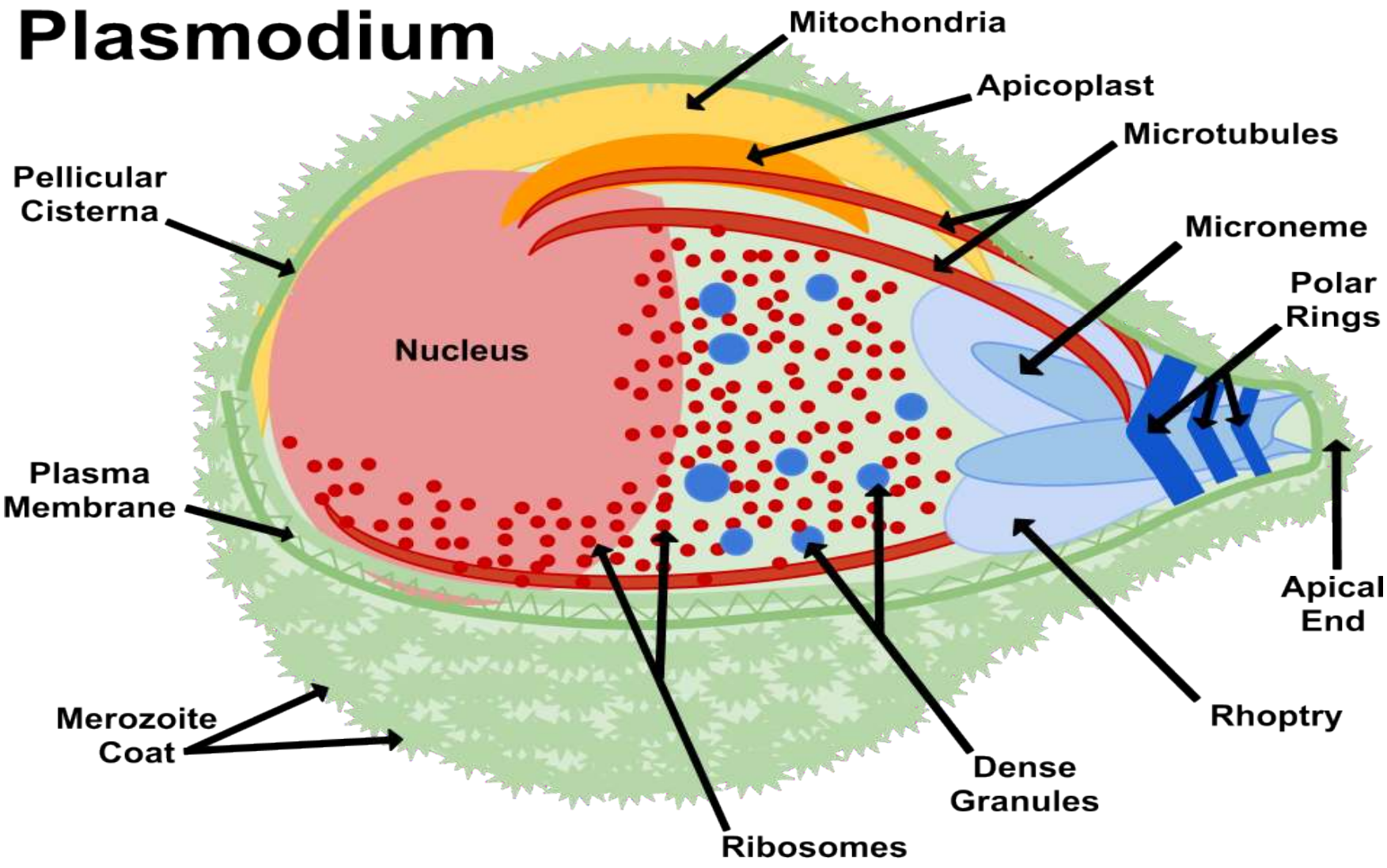
- **The febrile paroxysms occur with definite intermittent periodicity repeating every third or fourth day depending upon the species of the parasite involved.**

EPIDEMIOLOGICAL DETERMINANTS

AGENT

VECTOR – FEMALE ANOPHELUS MOSQUITO

PLASMODIUM- AGENT

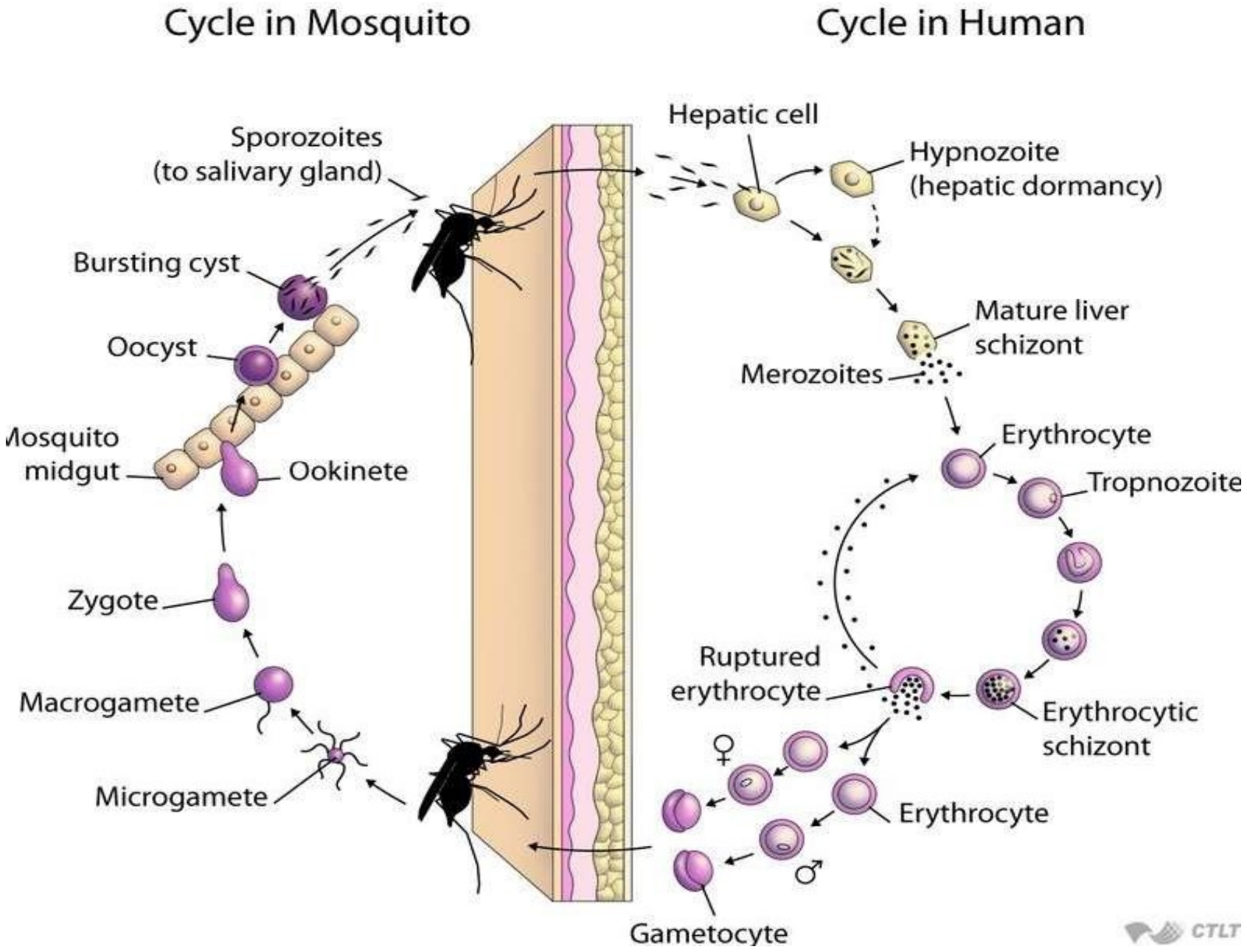


- **Malaria in man is caused by four distinct species of the malaria parasite.**

- **Plasmodium vivax, Plasmodium falciparum, Plasmodium malariae & Plasmodium ovale.**

LIFE CYCLE :

- **The malaria parasite undergoes two cycles of development .**
- **1. HUMAN CYCLE (ASEXUAL CYCLE).**
- **2. MOSQUITO CYCLE (SEXUAL CYCLE).**


Cycle in Mosquito
Cycle in Human
Sporozoites
(to salivary gland)
Bursting cyst
Oocyst
Mosquito
midgut
Ookinete
Zygote
Macrogamete
Microgamete
Hepatic cell
Hypnozoite
(hepatic dormancy)
Mature liver
schizont
Merozoites
Erythrocyte
Tropnozoite
Ruptured
erythrocyte
Erythrocytic
schizont
Erythrocyte
Gametocyte
♀
♂
CTLT

RESEVOIR OF INFECTION

- **A human reservoir is a person who harbours the sexual forms (gametocytes).**

- **A patient can be a carrier of several plasmodial species at the same time.**

- **Children are more likely to be carriers than adults.**

- **There are certain conditions to be fulfilled to be in the state of reservoir.**

- **The person must harbour both the sexes of the gametocyte in the blood.**

- **The gametocytes must be mature.**

- **The gametocytes must be viable.**

- **The gametocytes must be present in sufficient density to infect mosquitoes.**

- **There must be at least 12 gametocytes per cubic mm of blood.**

PERIOD OF COMMUNICABILITY

- **Malaria is communicable as long as, mature, viable gametocytes exist in the circulating blood in sufficient density to infect vector mosquitoes.**

- **Gametocytes are the most numerous during the early stages of the infection when their density may exceed 1,000 per cubic mm of blood.**

- **They also tend to occur in waves in the peripheral blood.**

RELAPSES

- **Vivax & Ovale malaria tend to relapse more than 3 years after the patient's first attack.**

- **Recurrence of falciparum usually disappear within 1-2 years.**

- **P. malariae has a tendency to cause prolonged low-level, asymptomatic parasitaemia.**

HOST FACTORS

AGE

- **Malaria affects all ages.**
- **Newborn infants have considerable resistance to infection due to a high concentration of foetal haemoglobin during the first months of life.**

GENDER

- **Males are more frequently exposed more than females due to their outdoor life.**

- **Females are better clothed than males.**

RACE

- **Individuals with AS haemoglobin (single cell trait)have milder illness.**

PREGNANCY

- **Pregnancy increases the risk of malaria in women.**

- **Malaria during pregnancy may cause intra uterine death in foetus.It may cause pre mature labour or abortion**

SOCIO-ECONOMIC DEVELOPMENT

- **Malaria demonstrated relationship between health and socio-economic development.**

- **It is observed that malaria has disappeared from most developed countries due to socio economic development.**

HOUSING

- **Ill ventilated and ill-lighted provide ideal indoor resting places for mosquitoes.**

POPULATION MOBILITY

- **Labourers connected with engineering, irrigation agricultural and other projects, migrating nomads are more disposed to develop malaria.**

OCCUPATION

- **Malaria is predominantly a rural disease and has direct connection with agriculture and related occupation.**

HUMAN HABITS

- **Human habits such as sleeping out of doors, nomadism, absence of personal protection measures increase the risk of contracting malaria.**

IMMUNITY

- **Epidemic malaria is influenced by the immune status of the population.**

- **Immunity is acquired only after repeated exposure over several years.**

Early diagnosis and treatment of cases of malaria aims at:

- Complete cure
- Prevention of progression of uncomplicated malaria to severe disease
- Prevention of deaths
- Interruption of transmission
- Minimizing risk of selection and spread of drug resistant parasites

Diagnosis :

ood Film: Confirmed by blood smear examination. Thick and thin
near are prepared and examined under microscope after staining
th Giemsa staining.

apid Test: Rapid whole blood immuno-chromatographic test is
nducted in community setting and for surveillance purposes.

rological tests: SGOT, SGPT, fasting glucose levels.

Diagnosis

- **Microscopy**: Stained thick and thin blood smears remains the **gold standard** for confirmation of diagnosis of malaria.
- **Advantages-**

1) The sensitivity is **high**.

2) It is possible to distinguish the various species of malaria parasite and their different stages

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- **Rapid Diagnostic Test(RDT):** Rapid Diagnostic Tests are based on the detection of circulating parasite antigens.
- Presently, NVBDCP supplies RDT kits for detection of P. falciparum at locations where microscopy results are not obtainable within 24 hours of sample collection.

Where microscopy result is available within 24 hours

Clinically suspected malaria case

↓

Take slide for microscopy

P. vivax	***P. falciparum***	**Negative**
CQ 3 days + PQ 14 days	ACT 3 days + PQ single dose	Needs further evaluation*

Where microscopy result is not available within 24 hours

Clinical suspected malaria case

Perform RDT

↓

RDT for *Pf*, Also prepare blood smear

↓

***Pf* RDT positive**
ACT 3 days + PQ single dose on Day 2

***Pf* RDT Negative**
Send blood slide to laboratory
Give CQ for 3 days, and await microscopy result

Microscopy result

- + ve for *Pv* - PQ for 14 days under supervision.
- + ve for *Pf* - ACT 3 days + PQ single dose on Day 2

RDT for *Pf* & *Pv*

↓

Positive: Treat according to species
Negative: Needs further evaluation*

REATMENT OF MALARIA UNDER NVBDC

tment for P.vivax

loroquine: 25mg/kg body weight X3 days

maquine: 0.25mg/kg body weight X14 days.

tment for P. falciparum (uncomplicated)

tesunate 4mg/kg X3d

lfadoxine (25mg/kg) pyrimethamine (1.25mg/kg)- on fi

y

maquine - 0.75mg/kg on second day

tment for mixed infection (P.vivax and P.falciparun

ll course of ACT and Primaquine 0.25mg/kg X14d

Chemoprophylaxis

- Chemoprophylaxis is recommended for travellers, migrant labourers and military personnel exposed to malaria in highly endemic areas.
- **Short-term chemoprophylaxis (less than 6 wee Doxycycline: 100 mg daily in adults and 1.5 mg/kg b** weight for children more than 8 years old. The drug should started 2 days before travel and continued for 4 weeks a leaving the malarious area.
- **Note: Doxycycline is contraindicated in pregnant an lactating women** and children less than 8 years.

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Long-term chemoprophylaxis (more than 6 weeks)

Mefloquine: 5 mg/kg body weight (up to 250 mg) weekly and should be administered two weeks before, during and four weeks after leaving the area.

Note: Mefloquine is contraindicated in cases with history of convulsions, neuropsychiatric problems and cardiac conditions.

Integrated Vector Management

Measures for vector control and protection include:

1) Indoor Residual Spray(IRS)

2)Insecticide Treated Bed Nets(ITN's)/ Long Lasting Insecticidal Nets(LLIN's)

3)Antilarval measures including source reduction

BREEDING HABITATS OF ANOPHELES MOSQUITOES

Indoor Residual Spray(IRS)

- **Indoor residual spraying** or **IRS** is the process of spraying the inside of dwellings with an insecticide to kill mosquitoes that spread malaria.

- The main purpose of IRS is to reduce transmission by reducing the survival of malaria vectors entering houses or sleeping units.

- IRS remains a valuable intervention in malaria control when certain conditions are met.

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Effectiveness of IRS depends on:

Target area

Selection of Insecticides

Change of Insecticide

Insecticide formulations used under NVBDCP

. DDT(Dichloro-diphenyl-trichloroethane)

. Organophosphorus (OP) compounds

. Synthetic Pyrethroids Strategies of Delay the onset of Resistance

ote: Recently GHMC in Hyderabad have introduced **Synthetic Pyrethroid** for IRS

Insecticide Treated Bed Nets(ITN's)/(LLIN's)

An insecticide-treated net is a mosquito net that repels, disables and kills mosquitoes coming into contact with insecticide on the nett material. There are two categories of ITNs:

- A conventionally treated net is a mosquito net that has been treated dipping in a WHO-recommended insecticide. To ensure its continu insecticidal effect, the net should be re- treated after three washes, or least once a year.
- A long-lasting insecticidal net is a factory-treated mosquito net mad with netting material that has insecticide incorporated within or boun around the fibres..

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Specific Objectives: Reduce Human contact, Reduce morbidity, Prevent deaths, Promote Community participation, Modalities for social marketing trough Public-Private Partnership.

Assessment of community needs by rapid surveys, size of he nets and number of nets according to size.

ynthetic Pyrethroids mainly two Deltamethrin(2.5%) at dosage of 25mg/m2 and cyfluthrin (5%) at 50mg/m2.

Anti-larval Measures

1) **Environmental control**: Good water management practices are best. Could be Temporary and Permanent.
2) **Biological control**: Fishes, Insects, Protozoans, Arthropods, Bacteria, Fungi & viruses.
3) **Genetic control**: Genetic Engineering like Transgenic Mosquito
4) **Chemical control**: Given high priority in Operational Measures.

Biological Control

Use of Biological Agents to control of vector populations

Biological Agents that work well :

1. Mosquito fish: *Gambusia* and *Guppy*
2. Bacteria: ***Bacillus thuringiensis*** and ***B. sphaericus***

Other Biological Agents:

- **Predatory mosquito larvae (*Toxorhynchites*)**
- **Copepods (*Macrocyclops albidus*)**

Urban Malaria Scheme(UMS)

- **OBJECTIVES:** The main aim is the reduction of the disease to a tolerable level in which the human population can be protected from malaria transmission with the available means.

- The Urban Malaria Scheme aims at :
  a) To prevent deaths due to malaria.
  b) Reduction in transmission and morbidity.

- **NORMS** :

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ontrol Strategies under Urban Malaria Scheme:

ector Control –

1) Source Reduction

2) Anti-larval methods- **Chemical** Recurrent anti-larval measures at **weekly intervals** with approved chemical larvicides like **Temephos.**

3) Use of larvivorous fish like gambusia and guppy

4) Aerosol space spray –

5) Minor engineering&Legislative measures

Epidemic Preparedness and Early Response

- Confirmation of an Outbreak
- Preparatory aspects like Constitution of Rapid Response Team(RRT) and Logistics
- Control of malaria epidemic by

  1. Delineation of the affected area
  2. Estimation of population involved
  3. Measures for liquidation of foci
  4. Follow-up Action

Surveillance in Malaria

- **Monitoring** Malaria incidence trends and geographic distribution.

1) Active Surveillance(Active case detection)

2) Passive Surveillance(PCD)

3) Sentinel Surveillance

IDSP in Malaria

- Malaria is under Regular Surveillance in Integrated Disease Surveillance Project(IDSP).
- **Case Classification:**

Suspect case- Any case of fever(in an endemic area).

Probable case- A case that meets the clinical case description.

Confirmed case- A suspect case with malaria parasites in blood film.

Interaction of Malaria Control with the Other health programmes

- **Integrated Disease Surveillance Project(IDSP) -** The Project with weekly fever alerts is increasingly providing early warning signals on malaria outbreaks.
- **Other Vector borne diseases -** Dengue & malaria control activities overlap in many Urban areas, Malaria & kala-azar in few districts of Jharkhand.
- **Reproductive and Child Health -** ANC services utilized in distribution of LLINs to pregnant women.

Elimination & Eradication of Malaria

- **Malaria control**: reducing the malaria disease burden to a level at which it is no longer a public health problem.

- **Malaria elimination**: *the interruption of local* mosquito-borne malaria transmission; reduction to zero of the incidence of infection caused by human malaria parasites in a **defined geographical area** as a result of deliberate efforts.

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- **Certification of malaria elimination:** the chain of local human malaria transmission by Anopheles mosquitoes has been fully interrupted in an entire **country for at least 3 consecutive years.**

- **Malaria eradication**: permanent reduction to zero of the worldwide incidence of infection caused by a particular malaria parasite species.

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- Key factors proposed for eradicating malaria:

1) Reducing Malaria Burden
2) Vector Control
3) Malarial Vaccine

Malarial Vaccine

accines developed are basically of three types:

re-erythrocytic stage vaccine **Blood stage**

accine and **Transmission blocking vaccine**

f-66—1st malaria vaccine that was tried in clinical trials in 990s.

TS,S--Most successful vaccine candidate, currently in Phase I

allenges facing vaccine development

Thank you