EPIDEMIOLOGY OF MOSQUITO BORNE DISEASES

DEFINITIONS
- Mosquito borne diseases are group of illness transmitted by mosquitoes, and caused by different classes of microorganisms, including viruses and parasites.
- Mosquitoes are small blood-sucking insects that depend on standing water to reproduce. Female mosquitoes must feed on blood to lay eggs.
- Mosquitoes are the best known disease vector and a perfect example of one of the many organisms that can host diseases without being affected themselves.

MOSQUITO SPECIES AND DISEASE TRANSMISSION

<table>
<thead>
<tr>
<th>GENUS</th>
<th>BITING PERIOD</th>
<th>BREEDING PLACE</th>
<th>DISEASE &amp; DISTRIBUTION</th>
</tr>
</thead>
</table>
| Anopheles mosquito: | Night         | Non polluted water: edges of rivers, swamps, tanks, rice fields, salt water w/o wave action. | - Malaria: Tropical & Sub-tropical areas.  
- Filariasis: Asia & Africa. |
| e.g. anopheles gambiae |               |                                                     |                                                                                        |
3. Chikungunya: Africa, Asia, Europe, Americas, Indian & Pacific Oceans  
| e.g. aedes egypti, aedes albopictus |               |                                                     |                                                                                        |
| Culex mosquito:     | Night         | Dirty water: waste water ditches, latrines, septic pits. | - Filariasis: Most tropical areas.  
Encephalitis virus: worldwide.  
West Nile fever: Europe & Israel. |
| e.g. culex pipiens, culex annulus |               |                                                     |                                                                                        |

TYPES OF MOSQUITO BORNE DISEASES

<table>
<thead>
<tr>
<th>PROTOZOA</th>
<th>Plasmodium Malaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>MYIASIS</td>
<td>Human Botfly:</td>
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<td></td>
<td>It attacks and uses a mosquito to deliver its eggs and transfer it to a human; the eggs are in the underside of the mosquito vector which is stuck with a special glue. When the mosquito takes a blood meal from its human host, the body heat of the host melts the glue and the eggs hatch into larvae which feed on human flesh and blood.</td>
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| HELMINTHIAISIS   | Filaria worms:     |
|                  | Lymphatic filariasis can cause a disfiguring condition characterized by a great swelling of several parts of the body; often referred to as elephantiasis. |

| VIRUS            | Viruses carried by mosquitoes are known as arboviruses:  
Yellow fever, Dengue fever, Zika fever and Chikungunya, Rift Valley fever, Ross River fever, St. Louis encephalitis, West Nile virus, Japanese encephalitis, La Crosse encephalitis, Eastern and Western equine encephalitis. |

PUBLIC HEALTH SIGNIFICANCE

- **Worldwide**, 700 million people get a mosquito borne illness resulting in greater than one million deaths every year.
- **Mosquitoes not only can transmit diseases to humans, but also** transmit several diseases to animals as dog heartworm, West Nile virus and Eastern equine encephalitis.
- **In addition, mosquito bites can cause** allergic reaction, severe skin irritation and itching.
- **Malaria**, the most widespread mosquito-borne disease, affects around 500 million people each year, also it is a leading cause of premature mortality in under 5 year children.
- **Dengue Fever** infects nearly 400 million people each year, causing an estimated 25,000 deaths and a huge economic loss in the affected countries.
- **Chikungunya, Yellow Fever, Eastern Equine Encephalitis and Zika Fever** are on the rise and increasing in prevalence; they are painful, debilitating and in some cases prove fatal.
- **Worldwide**, around 40 million people are living with a filariasis disability.
TRANSMISSION OF MOSQUITO BORNE DISEASES

- Through the bite of an infected mosquito.
- The rate of transmission depends on the following factors:
  1. Number of adult female mosquitoes.
  2. Frequency of feeding.
  3. Proportion of blood meals taken from the relevant hosts.
  4. Behavioral factors of mosquito, such as bite by day or by night, indoors or out.
  5. Length of IP in mosquito.

EPIDEMILOGICAL DETERMINANTS OF MOSQUITO BORNE DISEASES

1. MOSQUITO BORNE DISEASE DYNAMICS

- There are 3 crucial co-existing elements for the occurrence of mosquito borne diseases:
  1. Susceptible population (host).
  2. Vector (mosquito).
  3. Pathogen (e.g. virus, parasite).

- In areas where mosquito borne diseases most frequently occurs: conditions must be physiologically suitable for mosquitoes, host, pathogen survival, reproduction & replication.

2. GEOGRAPHIC AREAS

Mosquito-borne illnesses are normally rare to certain geographic areas, for example Dengue hemorrhagic fever is a usually regarded only as a risk in the tropics, however:

- Cases of dengue fever have been burst up in the U.S. where it has never been seen before.
- In 2015, mosquitoes had started to spread historically rare diseases to Europe due to climate change as malaria to Greece and chikungunya to Italy and France.

3. SEASONS

Most common during the summer and fall months when mosquitoes are active.

Effects of Climatic Changes on Mosquito Borne Diseases

- Increase the development, reproduction & survival rates of vectors.
- Alter behavior of the mosquitoes, influencing them to bite more often.
- Higher temperatures can also speed up pathogen development within mosquitoes.
- Higher temperature and increased rainfall may also shift vectors’ geographic range.

DENGUE FEVER

Dengue fever is an acute mosquito-borne infection.

- Etiological agent: Dengue virus that has 4 different serotypes of (flaviviruses).
- Mosquito vector: Aedes aegypti & Aedes albopictus

Types:

- Classical Dengue.
- Haemorrhagic Dengue.

Dengue Fever – Mode of Transmission

Dengue Fever – Symptoms

- Fever: continue for 3 to 7 days
- Severe headache
- Joint pain, muscle pain, pain behind eyeballs
- Nausea, vomiting, and rash.

In rare cases, the condition may worsen into dengue haemorrhagic fever, leading to internal bleeding, shock, or even death.
CHIKUNGUNYA
Caused by Alphavirus of family Togaviridae.
• 1ry vectors: Aedes albopictus or aegypti.
• 2006 – 2007 Outbreaks in India, Sri Lanka & Italy.
• Outbreaks have increased in scale and frequency in recent years.
• Distribution follows dengue as it can be transmitted by the same vectors.

LYMPHATIC FILARIASIS
Transmission by mosquitoes: Anopheles & Culex.
Filarial worms:
  ▪ Mainly Wuchereria bancrofti.
  ▪ Also Brugia malayi.
Clinical Disease of Lymphatic Filariasis
• Hydrocele.
• Elephantiasis.
• Tropical pulmonary eosinophilia.

PREVENTION AND CONTROL OF MOSQUITO BORNE DISEASES
Prevention of mosquito borne diseases effectively relies on the support & cooperation of both public & private sectors with the government.

1- Publicity and Health Education by:
• Providing health education on personal protection against mosquito-borne diseases for general public.
• Publicize personal protection against mosquito-borne diseases for travelers.
• Availability of latest updates on mosquito-borne diseases for healthcare workers through periodicals, mails and internet.

2- Disease Surveillance
  ➢ Contact tracing, epidemiological investigations on disease outbreaks.
  ➢ Coordinate with relevant sectors as environmental sectors to follow up control measures.
  ➢ Collaborate with other departments and hospital authority in formulating response measures to prevent local spread of diseases.
  ➢ Maintain close link with nearby regions & oversea countries.

3- Personal Protection
Personal protection is crucial to prevent mosquito-borne diseases; via avoiding mosquitoes bite by:
1. Limit outdoor activities at dawn and early evening.
2. Wear long sleeves & pants in mosquito-infested areas.
3. Use anti-mosquito measures as:
  • Nets to doors and windows so that mosquitoes can’t get in.
  • Repair holes in door & window screens.
  • Mosquito screens around bed.
  • Insecticides containing products, such as repellents, and spray to repel mosquitoes.

4- Elimination of Mosquitoes
The most effective way to eliminate mosquitoes is to:
  ▪ Keep the environment clean.
  ▪ Remove stagnant water that represent possible breeding places of mosquitoes including the natural and artificial containers.

Artificial containers:
As vases, trays under air-conditioners, dumped tires and solid wastes such as cans, disposable cups and bowls, and plastic bags.

Natural containers:
As hollows of a tree.

ELIMINATION OF MOSQUITOES
• Cover water containers tightly so that mosquitoes can’t get in to lay eggs.
• Dispose domestic wastes, empty bottles, cans and lunch boxes properly into a covered bin to prevent the accumulation of stagnant water.
• Remove or puncture any dumped tires to prevent the accumulation of stagnant water.
• Keep ditches free from blockage.

Seek medical consultation immediately
• Having been bitten by a mosquito & displaying symptoms afterwards
• Falling ill, especially having a fever within one month after you have returned from abroad

In cultivation ponds, water tanks or large containers, biological controls such as keeping fishes to eat mosquito larvae would be a good option.