KULLIYYAH OF MEDICINE & HEALTH SCIENCES
(Student's copy)

Course	Medical Parasitology
Semester/Year	3/ 2
Topic	Vectors of Diseases
Date	
Time	
Student's Name/ ID	
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Overview

Vectors are living organisms that can transmit infectious diseases between humans or from animals to humans. Many of these vectors are bloodsucking insects, which ingest disease-producing microorganisms during a blood meal from an infected host (human or animal) and later inject it into a new host during their subsequent blood meal.

Mosquitoes are the best-known disease vector. Others include ticks, flies, sandflies, fleas, triatomine bugs and some freshwater aquatic snails.

Key facts

- **Vector-borne diseases account for more than 17% of all infectious diseases, causing more than 700 000 deaths annually.**
- **More than 3.9 billion people in over 128 countries are at risk of contracting dengue, with 96 million cases estimated per year.**
- **Malaria causes more than 400 000 deaths every year globally, most of them children under 5 years of age.**
- **Other diseases such as Chagas disease, leishmaniasis and schistosomiasis affect hundreds of millions of people worldwide.**
- **Many of these diseases are preventable through informed protective measures.**

Vector-borne diseases

Vector-borne diseases are human illnesses caused by parasites, viruses and bacteria that are transmitted by mosquitoes, sandflies, triatomine bugs, blackflies, ticks, tsetse flies, mites, snails and lice. Every year there are more than 700 000 deaths from diseases such as malaria, dengue, schistosomiasis, human African trypanosomiasis, leishmaniasis, Chagas disease, yellow fever, Japanese encephalitis and onchocerciasis, globally.

The major vector-borne diseases, together, account for around 17% of all infectious diseases. The burden of these diseases is highest in tropical and subtropical areas and they disproportionately affect the poorest populations. Since 2014, major outbreaks of dengue, malaria, chikungunya yellow fever and Zika have afflicted populations, claimed lives and overwhelmed health systems in many countries.

Distribution of vector-borne diseases is determined by complex demographic, environmental and social factors. Global travel and trade, unplanned urbanization and environmental challenges such as climate change can impact on pathogen transmission, making transmission season longer or more intense or causing diseases to emerge in countries where they were previously unknown.

Changes in agricultural practices due to variation in temperature and rainfall can affect the transmission of vector-borne diseases. The growth of urban slums, lacking reliable piped water or adequate solid waste management, can render large populations in towns and cities at risk of viral diseases spread by mosquitoes. Together, such factors influence the reach of vector populations and the transmission patterns of disease-causing pathogens.

WHO response

The *Global vector control response (GVCR) 2017–2030* approved by the World Health Assembly (2017) provides strategic guidance to countries and development partners for urgent strengthening of vector control as a fundamental approach to preventing disease and responding to outbreaks. To achieve this a re-alignment of vector control programmes is required, supported by increased technical capacity, improved infrastructure, strengthened monitoring and surveillance systems, and greater community mobilization. Ultimately, this will support implementation of a comprehensive approach to vector control that will enable the achievement of disease-specific national and global goals and contribute to achievement of the Sustainable Development Goals and Universal Health Coverage.

WHO Secretariat provides strategic, normative and technical guidance to countries and development partners for strengthening vector control as a fundamental approach based on

GVCR to preventing disease and responding to outbreaks. Specifically, WHO responds to vector-borne diseases by:

- providing evidence-based guidance for controlling vectors and protecting people against infection;
- providing technical support to countries so that they can effectively manage cases and outbreaks;
- supporting countries to improve their reporting systems and capture the true burden of the disease;
- providing training (capacity building) on clinical management, diagnosis and vector control with some of its collaborating centres throughout the world; and
- supporting the development and evaluation of new tools, technologies and approaches for vector borne diseases, include vector control and disease management technologies.

A crucial element in vector-borne diseases is behavioural change. WHO works with partners to provide education and improve awareness so that people know how to protect themselves and their communities from mosquitoes, ticks, bugs, flies and other vectors.

For many diseases such as Chagas disease, malaria, schistosomiasis and leishmaniasis, WHO has initiated control programmes using donated or subsidized medicines.

Access to water and sanitation is a very important factor in disease control and elimination. WHO works together with many different government sectors to control these diseases.

Source: https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases

Topic Learning Outcomes (TLOs)

Students should be able to:

1. Define the term vector
2. List the disease(s) caused by the vector

References:

1. Franklin A.N. & Harold W. (1998). **Basic and Clinical Parasitology** (6th Edition) New York Prentice Hall.
2. Viqar, Z., & Loh, A.K. (1996) **Handbook of Medical Parasitology** (3rd Edition).
3. https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases
4. Wilson, A. J., Morgan, E. R., Booth, M., Norman, R., Perkins, S. E., Hauffe, H. C., Mideo., N., Antonovics, J., McCallum, H., Fenton, A. (2017). What is a vector? *Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 372*(1719), 20160085. doi:10.1098/rstb.2016.0085

Using the references provided and other possible resource materials in the library, answer the following questions.

1. Define the term vector.

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2. How do vectors pass diseases to other organisms?

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3. List the disease(s) caused by the vector

Vectors	Diseases
 *Aedes* mosquito	
 *Anopheles* mosquito	
 *Culex* spp.	
 *Mansonia* spp.	
 *Coquillettidia juxtamansonia*	

 Blackfly (*Simulium*)	
 Day-biting fly (*Chrysop*)	
 Midge (*Culicoides*)	
 Fleas	
 Sand flies	

 Ticks of the genus *Ixodes*	
 Triatomine bugs or kissing bug	
 Tsetse fly	

MULTIPLE CHOICE QUESTIONS

1. Lyme disease is carried by which type of organism?

   A. "tiger" mosquito *Aedes albopictus*
   B. *Aedes aegypti*
   C. *Anopheles*
   D. Tick
   E. Lice

2. How is *Leishmania donovani* transmitted?

   A. *Anopheles* mosquito bite
   B. Black fly bite
   C. *Culex* mosquito bite
   D. Sand fly bite
   E. Skin penetration by trauma

3. A biology graduate student who recently visited a tropical region of Africa presents with new visual impairment and the sensation that something is moving in her eye. She tells you that she is concerned because she had been warned about eye disease transmitted by black flies. When in Africa, she was in a river area, and despite her best efforts she received a lot of black fly bites. She also has some sub-cutaneous nodules. If her infection was acquired by black fly bite, what is the most likely causative agent?

   A. *Brugia pahangi*
   B. *Dracunculus medinensis*
   C. *Loaloa*
   D. *Onchocerca volvulus*
   E. *Wuchereria bancrofti*

4. A rural subsistence farmer from Brazil dies of heart failure. His autopsy shows a greatly enlarged heart. What was the vector for the most likely infectious agent that may have been responsible for his death?

   A. *Ixodes* tick
   B. Mosquito
   C. Reduviid bug
   D. Sand fly
   E. Tsetse fly