Committee: Environment Sub-Commission 1

Issue: Measures to control the spread of mosquito-borne diseases in Africa and Latin America

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INTRODUCTION

The issue of controlling the spread of mosquito-borne diseases is of major significance, since these illnesses influence the whole world negatively and, more intensely, the regions of Africa and Latin America. Although scientists, regional or international organizations and governments have made various attempts to bring an end to this problem, the effects of the diseases, such as illness or even death, still cause more and more suffering due to the international spread of the diseases. Therefore, the necessity of their elimination has become even greater throughout the last decades.

Mosquitoes are organisms that are responsible for a lot of human diseases and can cause more suffering than any other organism. They are bloodsucking insects that ingest disease-inducing micro-organisms during a blood meal from an infected host, which might be an animal or human, and later inject them into a new host during their next blood meal. Per the American Mosquito Control Association (AMCA), "over one million people worldwide die from mosquito-borne diseases every year."[1] Apart from the terrible impact these diseases can have on humans, mosquito-borne diseases can affect dogs and horses, among other animals, too. In the World Health Organization's (WHO) report in 1996, it is stated that "30 new diseases have emerged in the past 20 years. In addition, there has been a resurgence and a redistribution of old diseases on a global scale."[2]

DEFINITION OF KEY TERMS

[1] http://www.mosquito.org/mosquito-borne-diseases
[2] http://www.who.int/whr/1996/en/

Disease

A disease can be defined as "a condition of the living animal or plant body or of one of its parts that impairs normal functioning and is typically manifested by distinguishing signs and symptoms such as sickness, malady" [3]

Vector-borne diseases

"Vector-borne diseases are illnesses caused by pathogens and parasites in human populations. Every year there are more than 1 billion cases and over 1 million deaths from vector-borne diseases such as malaria, dengue, schistosomiasis, human African trypanosomiasis, leishmaniosis, Chagas disease, yellow fever, Japanese encephalitis and onchocerciasis, globally".[4]

Mosquito-borne Diseases

"Some mosquitoes are vectors for diseases. This means they can transmit diseases from one human or animal to another. Typically, the diseases are caused by viruses or tiny parasites. For example, a mosquito that bites an infected human or animal can pick up a virus along with the blood meal. The mosquito and virus do not harm one another but the virus reproduces inside the mosquito. Later, the mosquito can pass the viruses to other humans when biting them."[5]

Africa

"The second-largest continent, after Asia; located south of Europe and bordered to the west by the Atlantic Ocean and to the east by the Indian Ocean."[6]

Some of the African countries affected by mosquito-borne diseases are Nigeria, Democratic Republic of Congo, Mozambique and Burkina Faso.

In Nigeria, fatality rate by yellow fever is about 20%, while 90% of all malaria deaths occur in sub-Saharian Africa.

Figure 1: The region of Africa

[3] http://www.merriam-webster.com/dictionary/disease
[4] http://www.who.int/mediacentre/factsheets/fs387/en/
[5] http://npic.orst.edu/pest/mosquito/diseases.html
[6] http://www.dictionary.com/browse/africa

In DR Congo, Burkina Faso and Mozambique, dengue leads to death in 5% of the cases and the yellow fever fatality rate is less than 20%.

Latin America

"The part of the American continents south of the United States in which Spanish, Portuguese, or French is officially spoken."[7] Countries like Argentina, Brazil, Bolivia and Colombia are severely affected by mosquito-borne diseases. In Argentina, Bolivia and Colombia, malaria causes 1.5 to 2.5 millions deaths since 2000. In Brazil, about 1.5 million people have been infected by the Zika virus during the period of 2015-2016.

Figure 2: The region of Latin America

BACKGROUND INFORMATION

Mosquitoes and the diseases they can transmit

Mosquito type	Disease
Aedes aegypti	Dengue, yellow fever, chikungunya, Zika virus
Aedes albopictus	Chikungunya, dengue, West Nile virus
Anopheles (more than 60 known species can transmit diseases)	Malaria
Haemagogus	Yellow fever

Increasing Threat

Back in the 1940s, the discovery of insecticides and indoor spraying programs was a major breakthrough in the controlling of mosquito-borne diseases. However, within the last decades, many important diseases have re-emerged duo to the climate change. In other words, environmental changes are causing an increase in the number of vectors worldwide, and, more specifically in the numbers of mosquitoes.

Mosquito-borne diseases

[7] http://www.dictionary.com/browse/latin-america

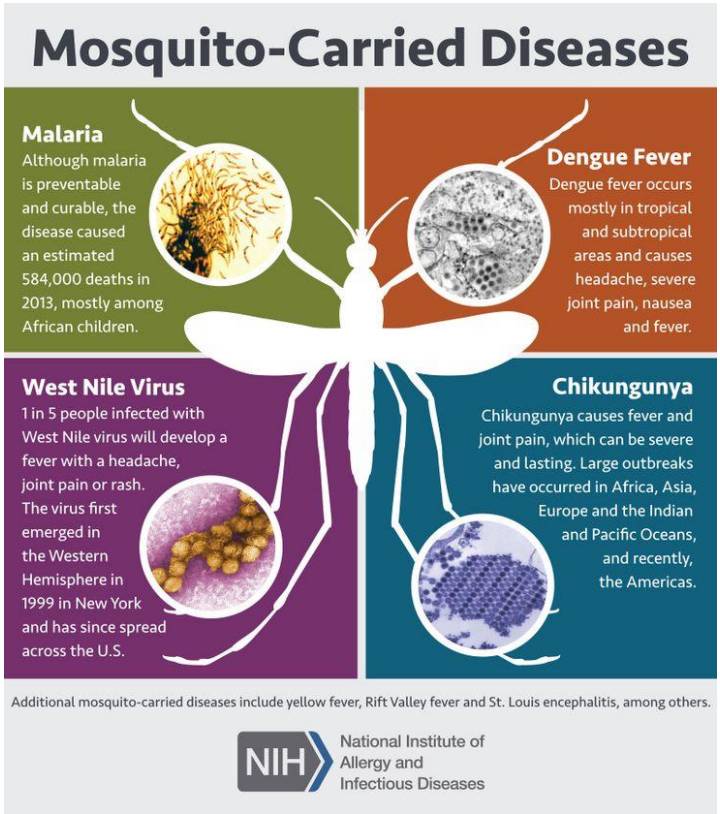
Mosquito-borne diseases are flourishing worldwide, however, in this study guide, we will mainly focus on the regions of Africa and Latin America. Despite all the efforts that have been made to control the spread of these diseases, unfortunately, they are responsible for high percentages of global morbidity and mortality with a disproportionate effect on children and adolescents.

The control of mosquito-borne diseases is a step forward towards the reduction of poverty. This is of outmost importance for the regions of Africa and Latin America as the diseases precisely target the poor. Mosquito-borne diseases are mostly diseases related with poverty and are responsible for major economic burdens through disability and missed educational opportunities for children and adolescents. Thus, it is no coincidence that many countries affected by these diseases are amongst the Less Economically Developed Countries (LEDCs).

Mosquito vectored diseases include protozoan diseases, i.e., malaria, filarial diseases such as dog heartworm, and viruses such as dengue, eastern equine encephalitis, yellow fever, zika virus and chikungunya.[8]

Malaria

Malaria originates in Africa and is an ancient disease. Plasmodium is the Malaria parasite transmitted by female *anopheles* (a genus of mosquitoes which can sometimes serve as vectors of some diseases) mosquitoes. According to the American Mosquito Control Association (AMCA), "The term malaria is attributed to Horace Walpole in a letter from Italy in 1740 and is derived from the Italian 'mal-aria' or 'bad air' because it was



[8] http://www.mosquito.org/mosquito-borne-diseases

thought to come on the wind from swamps and rivers." [9]

Some of the symptoms of the disease include fever, chills and flu-like illness. In 2015 an estimated 214 million cases of malaria occurred worldwide and 438,000 people died, mostly children in the African Region.[10]

Antimalarial drugs have been available for more than 50 years and recently scientists in Britain and the United States have cracked the code of the malaria parasite genome, a step that may help boost the campaign against the disease.[11] This means the elimination of the malaria parasite and, thus, the easier and more effective controlling of the disease.

Dog Heartworm

Dog Heartworm is a disease that threats the life of canines. It is caused by a roundworm. Dogs and other animals, like cats, are infected by the larvae of the worm through a mosquito bite which carries the larvae. In only rare cases can this disease infect humans, however we can say that it is dangerous for both canines and humans. The death of dogs and cats would mean the elimination of the specific species, a fact that proves that this disease is hazardous for the whole ecosystem.

Dengue

Dengue is a mosquito-borne viral infection, which has rapidly spread in all regions in recent years. It is transmitted by female mosquitoes mainly of the species of *Aedes aegypti* and, to a lesser extent, *Aedes albopictus*. The infection is responsible for flu-like illness and, sometimes, it can be life-threatening, unlike the usual dengue, a situation called *severe dengue.*

Dengue can be found in tropical and sub-tropical climates worldwide, mostly in urban and semi-urban areas. According to WHO, "Severe dengue is a leading cause of serious illness and death among children in some Asian and Latin American countries."[12]

[9] http://www.mosquito.org/mosquito-borne-diseases
[10] https://www.cdc.gov/malaria/

Figure 3: The most common mosquito-borne diseases

[11] http://www.mosquito.org/mosquito-
[12] http://www.who.int/mediacentre/factsheets/fs117/en/

Yellow fever

It is an acute viral hemorrhagic disease (includes bleeding disorders) transmitted by infected mosquitoes. This disease, at present, occurs only in tropical areas of Africa and America, such as Angola, Nigeria and Argentina.

Symptoms of yellow fever include fever, headache, jaundice (yellowish pigmentation of the skin), muscle pain, nausea, vomiting and fatigue. However, it can be prevented by an extremely effective vaccine (Yf-Vax), which has been tested and proved to be safe. Yf-vax provides a long-lasting protection or even immunity for most healthy individuals, but not all. That is why the yellow fever disease is still active.

Eastern Equine Encephalitis

Per AMCA, "Eastern Equine Encephalitis (EEE) is spread to horses and humans by infected mosquitoes. It is among the most serious of a group of mosquito-borne arboviruses (viruses that are transmitted by arthropod vectors) that can affect the central nervous system and cause severe complications and even death."[13] It is found in North America, Central and South America.

This disease is responsible for mild flu-like illness with fever, headache and sore throat. More serious infections lead to seizures and coma.

West Nile Virus

West Nile Virus (WNV) can lead to a fatal neurological disease in humans, transmitted by the bite of mosquitoes. WNV can be detected in Africa, Europe, the Middle East, North America and West Asia. Birds are the natural hosts of the virus.

Infection with WNV is either asymptomatic (no symptoms) in around 80% of infected people, or can lead to West Nile fever (fever, headache, tiredness, and body aches, nausea, vomiting) or severe West Nile disease (headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis.)[14]

[13] http://www.mosquito.org/mosquito-borne-diseases
[14] http://www.who.int/mediacentre/factsheets/fs354/en/

Vaccines are available only for horses and not for humans yet. A new vaccine is currently being designed and tested. Treatment is supportive for infected patients, including hospitalization, respiratory support and prevention of other infections.

Zika Virus

Zika virus disease is caused by a virus transmitted primarily by Aedes Mosquitoes. The symptoms of this disease are similar to other infections, such as dengue, and consist of fever, skin rashes, conjunctivitis, muscle and joint pain, malaise and headache. This disease was identified in Uganda and the united Republic of Tanzania. Outbreaks of Zika virus have been recorded in Africa and America as well. Nowadays, Brazil is a country that is threatened by the virus on a large scale.

Since sexual transmission of Zika virus has been documented in several countries, the risk of a potential pregnancy with severe complications is getting higher and higher. However, we don't know how the virus will affect the women or their pregnancy.

Treatment includes plenty of rest, drinking enough fluids and treatment of pain and fever via the usual medicines. If the situation gets worse, then the patient should seek for medical care. What is more, there is currently no vaccine available.

Chikungunya

Chikungunya virus is a pathogen transmitted by mosquitoes. It was first found in the Caribbean and, now, it is detected in 35 states, Puerto Rico and the U.S. Virgin Islands. Local transmission of chikungunya is now being reported in other countries in the South America.[15]

The symptoms are fever, joint and muscle pain, headache, lethargy and rash. The disease is rarely fatal. There is currently no vaccine and the treatment is limited to pain medication.

[15] http://wwwnc.cdc.gov/travel/notices/watch/chikungunya-south-america

MAJOR COUNTRIES AND ORGANIZATIONS INVOLVED

Mosquito-borne diseases are growing in scope: the mosquitoes that carry them are expanding their reach. Originally from Africa and Southeast Asia, the two invasive mosquito types can now be found in tropical and subtropical regions throughout the globe. They first arrived with the slave trade, and today's international shipping has helped to ferry them overseas. More detailed, as far as Africa and Latin America are concerned:

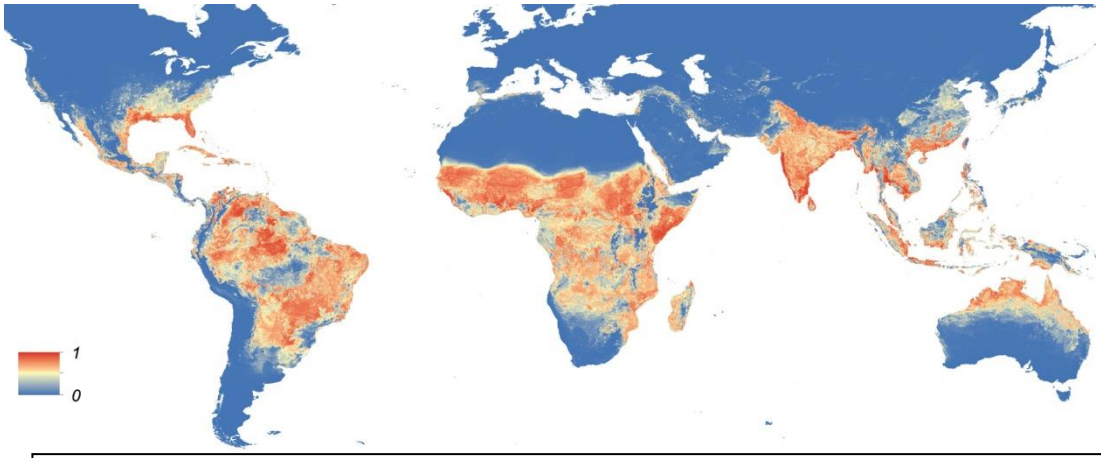


Figure 4: Distribution of mosquito-borne diseases around the globe

Africa

Around the world, malaria transmission occurs in 97 countries, putting about 3.4 billion people at risk. The disease burden is heavily concentrated in sub-Saharian Africa, where an estimated 90% of malaria deaths occur. Four out of ten malaria related deaths occur in the two highest burden countries: the Democratic Republic of the Congo and Nigeria.[16]

Nigeria suffers from malaria, which causes a lot of deaths (about 600,000 per year), and, therefore, the government of the country strives to promote preventive measures, such as indoor and outdoor spraying, so as to protect the citizens.

Dengue is now endemic in more than 100 countries in Africa (e.g Kenya and Angola), while there have been several outbreaks of chikungunya in the continent. At the same time,

[16]http://apps.who.int/iris/bitstream/10665/111008/1/WHO_DCO_WHD_2014.1_eng.pdf

yellow fever has occurred in recent years in seasonal workers, nomadic and displaced people in several African countries.

Latin America

Local transmission of chikungunya is now being reported in other countries in the South America. As of May 25, 2016, the following South American countries have reported cases of chikungunya: Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Venezuela.

What is more, in Argentina, there have been several outbreaks of Zika virus, as well as yellow fever and malaria. The Zika virus causes a lot of concern to health officials in Latin America, warning pregnant women from travelling to the area, since thousands of babies are being born with brain defects in the continent, particularly in Brazil.

World Health Organization (WHO)

The World Health Organization has a global health agenda that gives high priority to the controlling of mosquito-borne diseases by planning and implementing a wide range of interventions and projects. For instance, it has carried out a lot of indoor spraying in African countries, while it has launched campaigns all over the word, to raise awareness on the issue. What is more, the World Health Day is a day devoted on diseases and ways to combat them, including mosquito-borne diseases.

American Mosquito Control Association (AMCA)

The mission of this organization is to provide leadership, information and education leading to the enhancement of health and quality of life through the suppression of mosquitoes and the controlling of mosquito-borne diseases. It is world-wide in scope with members in over 50 countries.

Bill and Melinda Gates Foundation

This organization, established by the Microsoft founder and his wife, has committed $2 billion in grants toward malaria prevention and control and has enacted a comprehensive multi-year malaria eradication strategy.

Nothing But Nets

Nothing But Nets is an organization that partners with the World Health Organization (WHO), the United Nations International Children's Emergency Fund (UNICEF) and the UN Refugee Agency to create awareness and raise funds to fight malaria in Africa.

Mosquito Research Foundation (MRF)

The mission of the MRF is to fund research efforts that enhance mosquito control activities around the world, with the goal of eradicating mosquito-borne diseases.

Malaria No More (MNM)

Malaria No More (MNM) is a worldwide organization committed to eliminating mosquito-transmitted malaria deaths in children. With the help of financial contributions, MNM has been able to provide approximately 5.4 million mosquito nets that have resulted in a 58 percent decline in child malaria deaths in many parts of Africa since 2000.

United Nations International Children's Emergency Fund (UNICEF)

UNICEF is one of the largest buyers of mosquito nets in the world, delivering 22.3 million long-lasting insecticidal nets (LLINs) in 30 different countries in 2015. At the same time, UNICEF and WHO conduct a joint annual tender for Antimalarial medicines based on current WHO malaria treatment guidelines.

UN Women

This organization strives to protect pregnant women from the Zika virus. For example, on 7 April 2016 (World Health Day), it launched information campaigns around women's rights in response to the Zika virus.

African Union

The African Union, which consists of 54 member states, coordinates all the projects concerning the prosperity of the African Union and, thus, strives to eliminate and control the spread of mosquito-borne diseases through actions in cooperation with UNIFEC, WHO etc.

TIMELINE OF EVENTS

Date	Description of Event
1647-1650	Yellow fever is brought from Africa to Barbados on the slave ships. Wealthy white settlers on the island have no immunity to the disease. Six thousand of them die during an outbreak lasting several years.
1742	When the British send a 12,000 strong army to take Cartagena, Colombia more than half of them die of mosquito-borne disease.
1800s	Local populations in Africa and Asia enjoy immunity to yellow fever and malaria, but the same cannot be said for European explorers and soldiers. In the quest for dominion and colonial power, many thousands of them perish.
1904	The USA, under President Theodore Roosevelt, takes over work on the Panama Canal. William Crawford Gorgas is a hero for eliminating yellow fever in Cuba, largely by breaking the chain of infection and reducing mosquito breeding grounds. He is hired to eliminate yellow fever and malaria from the canal zone.
1930	In Brazil, entomologist Raymond C. Shannon finds a mosquito - *Anopheles gambiae* - a malaria vector. It probably arrived from West Africa on a destroyer ship used to deliver mail. World travel has opened up possibilities for vectors to move across countries and continents.
1943	DDT (dichloro-diphenyl-tichloroethane) is invented. An insecticide used initially to de-louse prisoners and refugees of World War II and therefore fight typhus outbreaks, the eradication of mosquitoes becomes a real possibility. The battle against malaria is declared almost won.
1947	Zika is first identified in Uganda in monkeys.
7 April 1948	Founding of WHO
1952	Zika is identified in humans
1962	US scientist, Rachel Carson publishes Silent Spring; a powerfully

	written book arguing that DDT is not safe. The reaction is immediate in several US states: DDT is banned. A nation-wide ban follows ten years later.
7 April annually	World Health Day (videos showing preventive were broadcasted, campaigns were launched etc)
2007	The first large outbreak of disease caused by Zika infection is reported from the Island of Yap, located in the Caroline Islands of the Western Pacific Ocean.
2014	Global WHO Theme: Vector Borne Diseases
2015	7,000 cases of illness related to Zika virus are reported in Brazil
2016	WHO declares that Zika virus infections constitute a major Public Health Emergency of International Concern

Source: http://www.ivcc.com/saving-lives/how-we-save-lives/history-of-vector-control

UN INVOLVEMENT: RELEVANT RESOLUTIONS, TREATIES AND EVENTS

- **A/RES/67/299**-Consolidating gains and accelerating efforts to control and eliminate malaria in developing countries, particularly in Africa, by 2015 , 1 October 2013
- **A/RES/68/301** -New Partnership for Africa's Development: progress in implementation and international support, 28 July 2014
- **A/RES/68/308**-Consolidating gains and accelerating efforts to control and eliminate malaria in developing countries, particularly in Africa, by 2015, 19 September 2014
- **A/RES/69/325**-Consolidating gains and accelerating efforts to control and eliminate malaria in developing countries, particularly in Africa, by 2015 and beyond, 6 October 2015
- **A/RES/70/183**-Global health and foreign policy: strengthening the management of international health crises, 18 February 2016

Constitution of the World Health Organization. **Parties: 194.** The Constitution establishes the WHO as an agency of the UN, whose purpose is to direct

and coordinate international health work. This includes strengthening health services, eradicating disease and taking emergency measures necessary to combat epidemics.

Convention on the Rights of the Child. **Parties: 193.** One of the world's most-ratified human rights treaty, the Convention on the Rights of the Child is dedicated to ensuring the protection of children Union. Also keep in mind that these numbers are subject to change.

Global WHO Theme 2014

On 4 April 2014, the World Health Organization published videos on ways to prevent the infection by mosquitoes. The videos focused on the travelling, as travelers are more at risk since they move from one country to another.

PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

According to the WHO's Global Brief on Vector Borne Diseases Report, a number of interventions to control and prevent the spread of mosquito-borne diseases exist. They depend on factors such as:

- Socioeconomic conditions of affected communities
- Cultural context
- Environmental change
- Local epidemiology of the disease
- Local ecology and behavior of the mosquito species

Figure 5: Long lasting insecticidal nets as a way to prevent mosquito bites

Some interventions currently in use include long lasting insecticidal nets, which are one of the most efficient and cost-effective methods, as well as indoor residual spraying that is effective for 3-6 months.

Outdoor spraying is used to control mosquitoes during epidemics of dengue and yellow fever. What is more, addition of chemicals to water is really effective at reducing mosquito larvae at areas of high risk.

Insect repellants in the form of coils, vaporizing mats and aerosols can also be effective in deterring and killing mosquitoes in and around houses. Furthermore, reduction of breeding habitats for mosquitoes is another option. More specifically, water storage containers can be designed to prevent access by mosquitoes for laying their eggs.

Biological and genetic control of mosquitoes can intervene in the controlling of the diseases. This can be achieved by the introduction of parasites, predators or other living organisms.

Waste management means collecting and recycling empty tins, plastic bottles, and unused drums and used car tires, which can serve as breeding sites for mosquitoes. In addition, houses should be constructed in a way which will deter mosquitoes. For example, they should be located away from mosquito habitats and should be fitted with door and window screens in order to keep insects out.

Personal protection and preventive measures include insect repellents, long-sleeved and light-colored shirts and trousers. Medication consists of any therapies that could help, and vaccination is currently available for some diseases, like the yellow fever.

The UN, through the UNTV and their official site, has been posting a lot of videos and information, in order to raise awareness on preventive measures.[17]

Between 2004 and 2013, international donors funded over 700 million bednets to protect families against malaria in sub-saharian Africa.

Currently, biotechnology companies (e. g OXITEC) are working on genetically engineered measures to combat the *Aedes Aegypti* mosquito population. A lot of research has been done on vaccines for the Zika virus, which will be available in 18-month term. Other techniques they are using are the Radiation-based Sterile Insect Technique (SIT), and RNA interference.

POSSIBLE SOLUTIONS

The delegates should look into evaluation of already existing measures regarding their effectiveness (e.g chemical insecticides, nets, indoor spraying), and examine whether it is effective or not to keep on relying on them.

[17] https://www.untvweb.com/

Collaboration between the health sector and the private sector with the target of surveillance of vectors and their diseases, as part of a national health information system is of major importance. This will enable them to coordinate further activities, since they will have collected any information needed. Donors and the private sector can also collaborate, so as to enhance coordination of campaigns.

Raising awareness on the importance of the issue, as well as on preventive measures, with the main actors being school officials, governments, Non-Governmental Organizations (NGOs) etc is a major part of the solutions, since people potentially affected by the diseases need to be aware of how to protected.

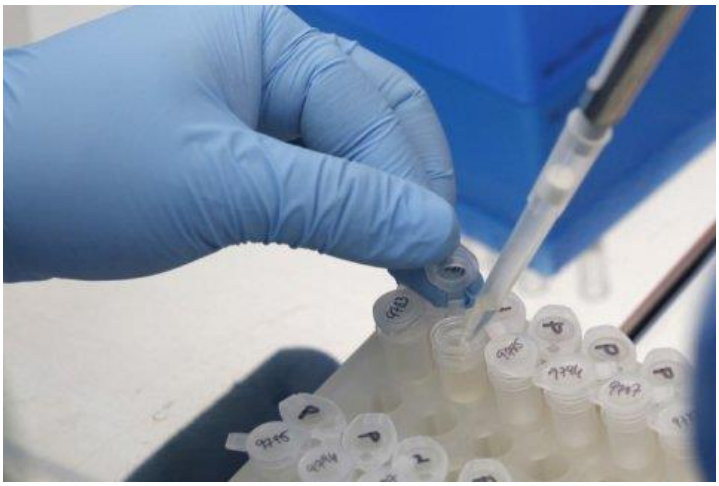


Figure 6: Research for vaccines needs to be done in order to control the diseases

The delegates should as well look into ways of funding for scientific research regarding vaccines and medical treatment. For example, the International Monetary Fund (IMF) can fund the research being carried for the Zika virus vaccine.

Action plans involving better hygiene and sanitation standards of living (e.g piping water to households) can contribute to the elimination of insect habitats.

What is more, governments could support financially the current progress made by biotechnology companies, in order to tackle the issue through genetic engineering and vaccines.

Programs related to the training of anyone who could help in this battle against the mosquito-borne diseases are of vital importance (e.g. local authorities, doctors).

Last but not least, climate change has an impact on the outbreaks of the diseases and, thus, delegates should carry research on that, in order to make their solutions more effective and applicable.

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