

Climate Change is Paving the Way for the Zika Virus

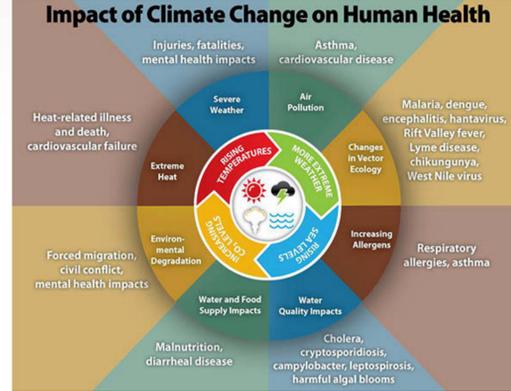
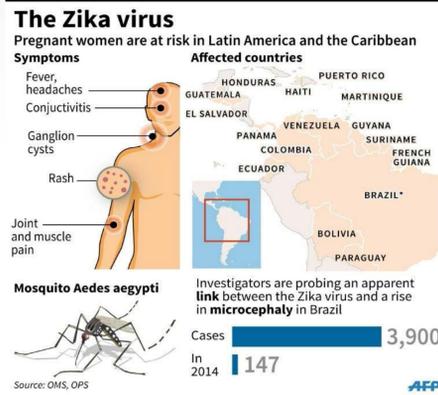
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Abstract

The Zika virus has had a horrific effect on certain geographical areas, leading to birth defects and infectious illnesses. Climate change has increased the range of the *Aedes Aegypti* mosquito, which is the primary vector for the Zika virus. This makes climate change an increasing threat to public health. Climatic temperature elevations have a direct relationship with an increase in mosquito populations and range, which ultimately leads to an increase in infectious diseases. A pregnant *Aedes Aegypti* mosquito can easily access the human bloodstream through insertion of the proboscis and transmit the disease. The disease can also be transmitted from person to person, which can result in a worldwide epidemic. While we cannot completely ameliorate climate change, the transmission of the Zika virus can be mitigated by factors such as sexual prophylactic sheets, water treatment plans, or further pursuing the genetic modification of male mosquitos. Understanding these implications of climate change on mosquito-borne illnesses is a crucial public health issue to prevent future epidemics.

Climate Change and Transmission

Due to warmer climate changes, the Zika virus and other vector transmitted diseases may be spreading to more and more places. Mosquitoes thrive and breed in warm moist climates. Breeding of infectious mosquitoes causes problems in that region. Mosquitoes such as the *Aedes aegypti*, the carrier for Zika, breed in stagnant water. Rain water pooled around houses or left in pots are excellent breeding grounds for potentially harmful mosquitoes. Warmer climates can lead to more precipitation and rainfall causing more stagnant water. On the contrary, hotter climates can lead to droughts and some scientists say this causes rivers and lakes to dry up but keep sections of still water for mosquitoes to breed. Climate change may not be happening very rapidly, but the smallest effects may make a big difference. According to the Intergovernmental Panel on Climate Change, "if emissions continue to rise unchecked — they are already 38 percent higher than in 1990 — the world could warm by as much as four degrees Celsius by 2100" (Shetty). Mosquitoes like to live in temperatures about 25-31 Degrees Celsius. For an area's temperature to increase to that range, it will allow more mosquitoes to populate in that area for a longer time. Some research is suggesting that by 2080, places in Africa will become too hot for mosquitoes to live. This change will probably only affect a certain area but still put northern areas at more risk. Tracking past diseases that originated in the warmest climates are today showing a greater range that it covers. Mosquitoes are shown to be more active in their preferred temperature range. During the short life span of a mosquito, it will want to spread its eggs anywhere it is safe. Adult male mosquitoes only have a life span of about 10 days. During the short 10 days, the male will need to breed as quick as possible. A female mosquito has a life span of about 42-50 days, this for carrying eggs and reproduction. Female mosquitoes may carry and lay up to 200 eggs during its life. Having these mosquitoes multiply in those numbers is perfect for a virus to potentially spread to a host. Having colder weather decreases the likelihood of mosquitoes populating. Due to climate change, the transmission rates will increase immensely. Female mosquitoes need the iron in blood for the eggs. In order to get these nutrients, a mosquito must suck the blood from a mammal. Having a hot moist climate where mosquitoes are reproducing rapidly, female mosquitoes will need to suck blood from any mammal it can get to. The more mosquitoes we have, the more likely it is for disease to be transmitted. Climate change will do a number of things to disease, and for our future, Zika virus may be spreading to new populations.



Background and History

The Zika virus is a recent new disease that caught attention to many Americans and civilians around the world who are interested in traveling to Brazil in the future. This disease has caught our attention for the fact that it is affecting pregnant women and causing their unborn child to potentially be born with birth defects. This can only happen if the mother who is still pregnant and is bitten by an infected mosquito species called the *Aedes aegypti* and spreads to the fetus and can also spread when the baby is being delivered. This has caused great panic and caused many females to be fearful in traveling to Brazil for the protection of their unborn child. Studies have shown that it can be transmitted from the male through sexual intercourse that may have been bitten by an infected mosquito. If this continues this could potentially become a genetic fear where it could be part of the gene pool and spread from one generation to the other. What we don't know about this virus is how likely the Zika virus will be passed on to her fetus. We also don't know if the infected fetus will develop birth defects and so we don't know when in pregnancy the infection might cause harm to the fetus. All that we know for sure is that it is affecting the women's unborn child which is the nation's future and we must do everything in our power to keep them safe and healthy. The most common symptoms of Zika are fever, rash, joint pain, or conjunctivitis which are red eyes. Other common symptoms are muscle pain and headache. The incubation period which is

the time from exposure to symptoms for Zika virus is not known, but it is most likely to be a few days to almost a week. The virus symptoms will last for about a week. The virus can be found in infected long but will mostly last for one week and for other people it might be longer. Research has found that the disease can't live without a host and if it would be exposed to the atmosphere or oxygen then the disease will most likely die. The Zika virus was first discovered in 1947 and reason it was called Zika is for the fact that the virus was found in a forest in Uganda. In 1952, the first time where humans or people contracted the disease and were detected since then. Majority of the outbreaks have been reported in tropical areas in Africa, Southeast Asia, and the Pacific Islands. Zika outbreaks have probably occurred in many locations. Before 2007, about 14 cases of Zika had been documented, although other cases were likely to have occurred they were not reported. Because the symptoms of Zika are very similar to many other diseases many doctors may not have been able to recognize it at the time. No vaccine exists to prevent when in pregnancy the infection might cause harm to the fetus. This virus has also had some similarities to other disease that have been found in tropical areas that has been spread by mosquito and don't have cures yet. That is the back round of the Zika virus.

Zika and the Fetus

Zika virus has been a threat to all pregnant women since it has a major effect on the fetus. Infected pregnant women with Zika virus, give birth to a child with abnormal small head size. This abnormality is known as microcephaly, which is classified as a neurological disease leads to mental retardation and other problems that the diagnosed child can develop through growth. On the other hand, some children with microcephaly develop normal intelligence as they grow up. In case of Zika virus, the microcephaly is more severe that lead to death of some children by either miscarriage or death shortly after birth. This disease is being influenced by environmental and genetic factors. There is no treatment for the disease other than treatment support and close monitoring the patient. Zika doesn't only show adverse effects after delivery, but also while pregnancy. Once the pregnant mother is infected, there are chromosomal abnormalities developed as well as fetus infection and reduction of oxygen level in the brain. However, the reason that the fetus develops microcephaly is still unknown. Researches are heavily

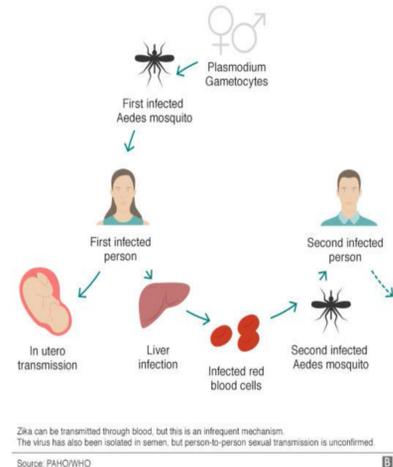
conducting researches and experiments to understand the mechanism of action as well as proving the connection between Zika infection, developing microcephaly and whether its possible to produce a vaccination or treatment. Interestingly, it is not guaranteed that every infected pregnant woman will have a child with microcephaly. Nevertheless, miscarriage has been linked to the infection of Zika virus. Pregnant women have been worried about the possibility of getting infected by Zika. Unfortunately, there is no diagnostic test that the pregnant woman can have. On the other hand, there's a blood test that can be taken for every woman who has been at Zika infected area; those tests goes through the center for disease control (CDC) and the results may take weeks to come back. Microcephaly could also be detected with ultrasound between the 18th to the 20th week of pregnancy. Sometimes, the disease will not be detected by ultrasound until the beginning of the third trimester. There is no risk of birth defect for future pregnancies after the infection since the virus is cleared from the blood within a week according to CDC.

Prevention and Treatment

While the Zika virus does not have any current vaccines against it, there are multiple ways to go about the treatment and there are simple ways to combat its spread. Since the Zika virus has been reported mainly in areas such as Southeast Asia, tropical regions in Africa, and South America. Due to its prevalence in these areas, travel to these regions is not recommended. If, by chance, someone happens to visit one of these areas, long sleeve shirts, pants, closed shoes, and mosquito repellent are vital to protection from Zika, due to the fact that the primary vector for the virus is the *Aedes aegypti* mosquito. For additional protection, it is recommended to stay indoors, if possible, in a swampy area during the daytime. Mosquitos thrive in warm, humid environments and are more likely to transmit the disease if they are healthy. If infection is suspected, there are additional steps to prevent the spread of the disease. The common symptoms of the Zika virus are fever, muscle/joint pain, headaches, rash, and conjunctivitis. If a person is showing these symptoms, it is recommended that he or she avoid any situation that involves the presence of mosquitos. By preventing the opportunity for a mosquito to bite an infected person, it inhibits the spread to another person or region. Any bodily fluid contact with an infected person is inadvisable, because the virus lives in the bloodstream and can infect the semen of a male. Sexual contact with bodily fluids should be limited by the use of prophylactic sheets, especially since the virus is suspected to last longer in semen than the bloodstream. However, symptoms of the virus are not always present. Infection does not correlate

with visual symptoms. Therefore, if a person has traveled to any of the regions spawning the disease, it is recommended that physical contact with any other human remains minimal for a time period of seven to ten days. If a woman is pregnant and has travelled to an infected region, especially South America, she should see a doctor upon return to check for the virus. Not only does the woman have a chance of transmitting the virus onto other living people, but also her fetus could potentially develop birth defects, such as microcephaly, due to the Zika virus infection. If a doctor or medical expert confirms infection, there are ways to minimize the symptoms. While a medication to treat a Zika virus infection has not been developed, other medications such as acetaminophen or paracetamol has the ability to reduce fever, swelling of the joints, and muscle pain. However, it is noted that non-steroidal anti-inflammatory medications should not be taken until other Flaviviridae viruses, such as chikungunya, are tested negative for, to prevent the risk of internal bleeding. Simple ways of reducing symptoms such as getting rest, staying hydrated, and maintaining a nourishing diet are also recommended. Once a person has been infected with the Zika virus, he or she likely does not need to take precautions to prevent infection in the future. Since viruses tend to lay dormant in the bloodstream and can be recognized by the body, once the virus enters the blood again, the lymphatic system fights it off so the person is likely to be protected against a second infection.

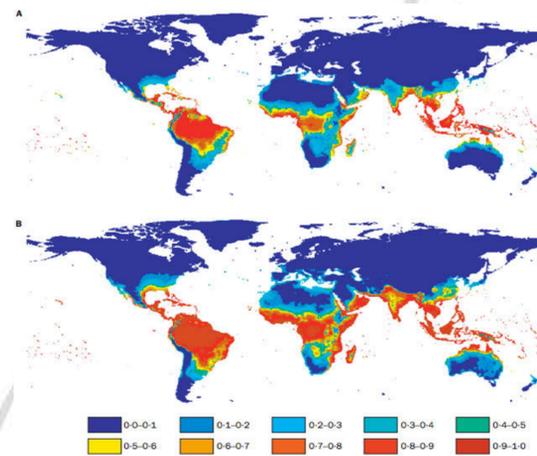
Zika virus transmission cycle



Vectors and Transmission

The Zika virus is currently making headlines worldwide, as it is spreading rapidly across the continent of South America. The reason for this rapid spread is a direct result of its primary vector, the *Aedes aegypti* mosquito. The *Aedes aegypti* mosquito has become infamous for its affiliation with the transmission of several pathogens aside from the Zika Virus, such as Yellow fever virus, Dengue, and Chikungunya virus. When the female *Aedes aegypti* mosquito pierces the skin of the host using its proboscis, it draws blood from the host to utilize the protein and iron from the blood to form its eggs. This process is repeated multiple times during the 2-4 week lifespan of the mosquito, and any pathogens that the mosquito is exposed to have the potential to spread to any future hosts. The *Aedes aegypti* is drawn to hosts using chemical markers as a way to track potential hosts. The mosquito is drawn to chemical compounds such as ammonia, carbon dioxide, lactic acid, and octanol. The *Aedes aegypti* mosquito has been shown to prefer humans as hosts, but also will draw

blood from other mammals. As a result, traces of Zika virus and Zika virus antibodies have been identified in rats and monkeys, implying that they might be involved in the transmission cycle as well, much like in the case of Yellow fever. During the past few years the numbers that make up the population of the *Aedes aegypti* mosquito have been steadily rising, presenting a resurgence in the activity of the *Aedes aegypti* mosquito. With these rising populations of mosquitos, an increase in the transmission of pathogens is guaranteed. Aside from the rising populations, the *Aedes aegypti* is able to adapt to both urban and non-urban environments, needing only a source of stagnant water to breed, meaning that future development and urbanization would not significantly hinder their ability to survive, as well as transmit pathogens. This is extremely alarming information, due to the fact that the *Aedes aegypti* mosquito is found almost all throughout the world. Aside from the *Aedes aegypti* mosquito, two cases of the Zika virus being transmitted sexually have been reported.



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