

Zika Virus: Facts and Recommendations for Control

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Abstract

By the end of January 2016, there were about 4000 cases suspected to be due to the Zika virus reported in Brazil, and about 4700 reported in Venezuela. The World Health Organization (WHO) pronounced Zika as a worldwide crisis on February 1, 2016. There are at least four little known facts about the Aedes mosquito, which is the insect vector for the Zika virus. Better dissemination of these facts can help in preventing individuals from being bitten and infected with Zika. In addition, from basic science, it is pointed out other possible methods of virus transmissions. A possible strategy to slow the spread of Zika is also presented.

Keywords: Zika; Virology; Insect vector; Microcephaly; Sexual intercourse; Bodily fluids

Background

There are millions of viruses in a drop of seawater. It is a tremendous challenge to study all of them, and figure out which ones are pathogenic. This would be one of the reasons for the epidemics that have plagued us humans in recent years. 'Current Opinion in Virology' [1] is a reputable journal. The name gives an idea of the state of the art with regards virology. It takes time for opinion to be accepted as theory in a practical science, even though there is scientifically collected data.

Viruses and their antibodies that are known to be present in the body for a long time after infection and or recovery, include Dengue Fever virus, Herpes simplex virus (HSV), varicella-zoster virus (VZV) or chickenpox virus, Epstein-Barr virus, small pox virus, Hepatitis B virus, Human Immunodeficiency Virus (HIV), Human Papilloma virus (HPV). "Human Papilloma virus is the most common sexually transmitted infection (STI). HPV is a different virus compared to the HIV and the HSV (herpes)". HPV is ubiquitous enough that almost all sexually active men and women become infected at one point in their active periods. There are numerous kinds of HPV. Certain cancers and genital warts are caused by a few types [2]. This paragraph is a short and not comprehensive summary of the pathogenic viruses that are commonly found in human blood.

In 1947, the mosquito-borne flavi virus, Zika virus or ZIKV was first found in a monkey species in Uganda, Africa [3]. In 1969, the Zika virus was isolated from the Aedes mosquitoes in Malaysia [4]. The Zika virus was reported as recently as 2008 in Micronesia, because of the outbreak there [3,5].

Facts and Deduction

Symptomatology

The year 2016 began with news that the Zika virus, with the mosquito as the disease vector, has been creating havoc in 23 countries and territories (for starters) in the Americas. "For adults, the illness from Zika virus is usually mild with symptoms lasting from several days to a week". The Centers for Disease Control and Prevention (CDC) said [6]. A complete

list of symptoms is listed in [6]. From the Miami Herald newspaper on January 20, 2016: "There is no vaccine to prevent the virus and no medicine to treat Zika. The biggest concern is for women of child-bearing age. There is a link between the disease and children with damaged, smaller than normal brains microcephaly". The prognosis is often a short life full of problems for the baby. "The disease is spreading throughout South America, Central America and the Caribbean. Travelers are warned (by the Centers for Disease Control (CDC) in the United States) against visiting Brazil, Colombia, El Salvador, French Guiana, Guatemala, Haiti, Honduras, Martinique, Mexico, Panama, Paraguay, Suriname and Venezuela". Zika has affected people in Puerto Rico, and Hawaii. There is even a baby born in Hawaii with microcephaly; the mother spent time in Latin America.

By the end of January 2016, 31 cases of the Zika virus have been found in the United States of America (USA). Most of these cases were a result of persons travelling to another country and returning home with the infection.

One good way to limit spread of the Zika virus is to restrict travel to infected areas, as per the CDC travel advisory. It is necessary to clean up any stagnant water around one's house and one's place of work, so that the mosquitoes have no place to breed. Another effective action by everyone is to prevent mosquito bites. Once the virus becomes resident in more than the 'critical mass' of persons, it will become endemic *via* mosquito bites. This is shown by the spread in the countries with travel advisories. By December 19, 2015, there were 2,782 suspected cases and 40 deaths blamed on Zika in Brazil [7]. Towards the end of January 2016, there was a report of about four thousand cases. At about that time in January 2016, Venezuela had reported four thousand and seven hundred unconfirmed Zika cases [8]. Just like Dengue Fever, this virus spread by the Aedes mosquito vector can be very dangerous.

Unlike the Dengue Fever virus, the Zika virus only lasts at most for 1 week in humans, according to Anthony Fauci, head of the U.S. National Institute of Allergy and Infectious Disease. Fauci also stated that mosquitoes have no use or purpose on this Earth. Scientists and

physicians have not succeeded to halt this kind of disease transmission yet, even after so many years of study and effort based on the infamous malaria. Bill Gates of the Gates Foundation fame had this statement to make regarding mosquitoes. “The mosquito is the most dangerous animal on Earth” [9] was Bill Gates’ statement, and he was only referring to the amount of deaths related to malaria worldwide, which is mainly spread by the Anopheles mosquito. The Aedes mosquito has many common characteristics similar to those of the Anopheles mosquito. However, there are other characteristics of the Aedes mosquito which are specific, and this is the focus of the next sub-section.

Vector behavior

Facts about Aedes mosquito which may not be widely known are outlined below:

1. The Aedes mosquito bites at any time of the day or night [10], more so during the day time, unlike the Anopheles mosquito which spreads malaria. Hence, use of mosquito nets over beds may not be very effective in preventing one from Aedes mosquito bites.
2. It prefers humans to other animals [11]. The practice of keeping a pet nearby as a sacrificial victim for the mosquitoes is not going to be effective. In other words, the Aedes mosquito has domesticated humans, and is as comfortable in our houses as they are on the outside.
3. Aedes mosquito can breed in small amounts of water, in vases and plants. One popular garden plant to note is the bromeliad [12,13]. Even small quantities of water like one table spoon full of water can hold about 300 eggs of the Aedes mosquito; this makes it important to keep dry every item that can hold water indoors and outdoors.
4. Air-conditioning helps in keeping mosquitoes out *via* closed windows and doors. However, the mosquitoes thrive at temperatures above 50°F [14]. Almost all air-conditioning spaces for humans are kept at temperatures higher than 50°F. Thus, mosquitoes do live and thrive in most air-conditioned spaces. It is this fact that contributes to the fact that the Zika disease, like Dengue Fever, will hit the well-heeled and the poor alike.

Control of the virus

The background information about the Zika virus in Malaysia presented above (from 1969) imply to this researcher that the Zika virus does not necessary reside long term in the blood of the peoples of Southeast Asia. If it does reside long term in infected person’s blood like some of the other viruses e.g. Dengue Fever virus, then the absence of microcephaly cases so far in Malaysia and other surrounding countries imply that there is probably another mechanism involved in microcephaly, even after the Zika virus were to be linked to microcephaly. In other words, there may be necessary conditions for microcephaly, and there are sufficient conditions that need to be researched and studied further down the road. The evening news of BBC America on January 28, 2016 [15], the spokesman from the CDC stated that there is one case of a man infected with Zika, passed it to his wife *via* intercourse. The infected man’s wife had not left the USA at all [16]. On February 3, 2016 it was reported that another case of Zika was reported to have been transmitted *via* unprotected sex in Texas [17]. It may be significant that the Zika virus may be spread *via* bodily fluids exchange during sexual intercourse. This last point gives the impetus to stop the Zika virus in its tracks at their entry points into the United States of America (USA), i.e. the states of Florida and Texas. Once within these states, the Zika virus may be spread widely and swiftly *via* sexual intercourse among adults with many sex partners; this last is a statistically common behavior among North Americans. In other words, if the Zika virus can be spread *via* sex, it will be spread even more by persons with more than one sexual partner at any period of time. To be fair, many

sexual relationships are monogamous. However, there are many open relationships among the married and serious dating and sleeping around among the unmarried. Safe sex (with condoms, etc.) should be practiced, since many infected persons show no symptoms.

The avian-flu virus is found in chicken eggs sold commercially. The bird-flu epidemic which swept through the USA, starting December 2014 and continuing into 2015, caused the warning to be proclaimed to eat eggs that were cooked thoroughly, i.e. no runny yolks. Viruses like the H5N1 virus, and HIV, and HPV, can be transmitted *via* bodily fluids during acts of intimate human interactions. It is suggested that the Zika virus can also be transmitted *via* bodily fluids exchange during sexual intercourse.

From [18], “the H1N1 flu virus caused a world-wide pandemic in 2009. It is now a human seasonal flu virus that also circulates in pigs”. The symptoms of swine flu are similar to the seasonal flu symptoms. In addition, the propagation of this flu (and the virus) is *via* the same method as the seasonal flu. The avian (bird) flu and this swine flu information were cited to present the fact that fundamentals in basic science would have probably let to those foregone conclusions.

From [19], in the United States, “Aedes aegypti found in 23 states, including the south-eastern USA, up the east coast to New York, and west to Indiana and Kentucky (Darsie and Ward2005) although in some areas Aedes aegypti populations are decreasing due to competition with Aedes albopictus. Aedes aegypti is still a common mosquito in urban areas of southern Florida, and in cities along the Gulf coast of Texas and Louisiana”. That Aedes albopictus competes with Aedes aegypti is immaterial. The Aedes albopictus has been found to be guilty of carrying the Dengue Fever virus. Nothing will prevent the Aedes albopictus from acting differently with the Zika virus.

The Aedes mosquito lives in Florida and south-eastern Texas. It is known to transmit the Dengue Fever virus, the Yellow Fever virus and the Chikungunya virus, besides the Zika virus [19]. These diseases often “emerge in temperate regions during summer” [19]. The reason is that the mosquito has a “cosmo-tropical distribution annually, and spreads to more temperate regions during the summer months” [19].

“The role of the microbiota of the mosquito is just beginning to be explored, as is the impact of mosquito-specific viruses on infection and transmission” [1]. Studies in this area would help to prevent the spread of the Zika virus.

Discussion and Conclusion

Vector behavior

In reference [19], recommendations are provided for limiting the potential places where the Aedes mosquito and other mosquitoes could breed. “By turning over empty flowerpots, properly maintaining swimming pools, and removing unused tires, you can greatly reduce the number of places mosquitoes have to lay eggs. Aerate bird baths and make sure gutters are free of blockages. Clean pet bowls every day and always empty overflow dishes for potted plants.” [19]. These recommendations have not included keeping used tires dry in junkyards and other commercial places, and the assumed proper maintenance of swimming pools. The latter is because private swimming pools are normally part of houses in better neighborhoods, and thus well maintained.

For the author who grew up in a country surrounded by other countries where malaria is endemic, the teachings learned since elementary school with regards mitigating mosquito bites and limiting their nesting areas, there are still relatively unknown facts about Dengue Fever [14] and Zika that needs to be shared more broadly. These four facts have been presented in the current work.

Suggested strategies

It would be a socially interesting experiment to ask the public (as well as the national and international visitors) to practice safe sex in their sexual relationships. In addition, monogamy would certainly slow the speed of spreading a virus. The compliance percentage would probably be as low as the percentage voting in Northern Alaska for the national elections, during a bitter winter blizzard. Hence, it is deduced that sex could be an important mechanism by which the Zika virus will spread beyond the borders of Florida and Texas. After such a long time of trying to eradicate malaria (the vector is also a mosquito), we humans have not been able to achieve the ultimate goal. We cannot expect the spread of the Zika virus to be any different; the *Aedes* mosquitoes in Florida and Texas cannot be expected to cooperate and not spread the virus. The recommendation here is for safe sex practices (use of condoms, etc.)

Although the Zika virus is predominantly transmitted by the *Aedes* mosquito, it may not be the only way in which the virus can spread among humans. One case in the USA has been confirmed that was transmitted by a man to his wife *via* sexual intercourse [16]. This case implies that the mucosa can be penetrated by the Zika virus. It has also been found that the Zika virus is alive in the reproductive organs of a Zika infected man. For a large scale study to include the possibility of sexual intercourse as a transmission method would make the study more complex. For the same study to include the possibility of transmission of the Zika virus *via* casual contact through a runny nose, kissing, etc. can really increase the order of magnitude of the large scale study. It might be useful and thus advisable to let the public know about these other possible methods of viral transmission before the disease becomes endemic. The widespread dissemination of this kind of information may persuade people to be more cautious about casual sex and casual contact, and lead to less spread of the disease with concomitant savings for the state and the country.

In other words, the scope of the current discussion includes a preemptive strategy that will eliminate two likely transmission methods, however low the probability, slow the spread to a single transmission method *via* mosquitoes so that resources may be focused on establishing the link between Zika to microcephaly. This particular malady is a particularly heart-wrenching one on the babies and no effort should be spared to stop it, even if calls for personal restraint and self-sacrifice.

There is an opinion, maybe not the most popular, that there is a waning of basic science articles in many medically-related journals. If medical residents and clinicians are not attune to basic science and advances in that field, they may develop the attitude that only epidemiological studies and therapies are important. For the discussion at hand, it would come in the form of neglecting the 2 types of virus transmission that basic science cannot deny may be significant (and worth warning about).

On February 4, it was reported that the Zika virus was transmitted *via* blood transfusion in 2 cases [20,21]. It does not matter where the cases were found, or anywhere else in the world. This method of transmission should not be totally unexpected, for basic medical science would have predicted that.

At the end of January 2016, a Finland Zika case was reported [22] which were contracted in the Maldives in the summer of 2015, on the other side of the world from the Americas. After an emergency meeting, the World Health declared that Zika is a worldwide crisis on February 1,

2016. This had something to do with the suspected link of microcephaly to the Zika virus. It was estimated that there would be four million cases of Zika in the Americas by the end of the year.

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