Microcephaly Surge in Brazil Linked to Zika: A Review of the Literature.

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Microcephaly is not a common condition; however, rates of this condition can be more prominent in less developed countries. Brazil particularly saw a surge of this condition in the years 2015-2016. This surge has been linked to an increase in the Zika virus in the area. To understand this connection, it is important to know what microcephaly is, what Zika is, how Zika can cause microcephaly, and why Brazil had this surge of Zika and therefore a surge in microcephaly. Once these components are understood, a connection can be seen between the presence of Zika and the number of microcephaly cases.

Microcephaly is "a condition in which a baby's head is much smaller than expected" (Centers for Disease Control, 2016). In a standard pregnancy, while the fetus is growing, its brain is growing. A baby with microcephaly has a brain that has either not fully developed or has stopped growing at birth and this can result in a smaller head circumference. Like most congenital conditions, microcephaly can coexist with other conditions. Some of those conditions can include: seizures, intellectual disability, deficits in balance and movement, trouble swallowing, and loss of hearing and vision (Centers for Disease Control, 2016). The number of these coexisting conditions will vary as the severity of the condition varies. A baby with very mild microcephaly could have no coexisting conditions, whereas, a baby with severe microcephaly could have numerous coexisting conditions. Although this condition can have a significant effect on the life of the babies who are born with it, it is only affects between 2 and 12 babies per 10,000 babies (McNeil, D., 2016).

There are various known causes of microcephaly. The most common cause of microcephaly is the fetus's exposure to alcohol, certain drugs, or toxic chemicals while in the womb. These substances can stunt the growth of the fetus in crucial times of development. Severe malnutrition of the mother can cause the fetus to not get enough nutrients and food to develop properly. Infections like rubella, toxoplasmosis, and cytomegalovirus can contribute to microcephaly in a baby. Interruption of blood supply to the fetus's brain before or during birth can cause the brain to be undeveloped and in turn cause a smaller head circumference that is microcephaly. Finally, the influx of Zika in the past couple of years has been linked to microcephaly. Some mothers who have been infected with the Zika virus while pregnant have seen a stunted growth in the brains in their newborns.

A diagnosis of microcephaly can be made either during the pregnancy or after the baby has been born. If the diagnosis is made during pregnancy, an ultrasound is done towards the end of the second trimester or the beginning of the third semester. The ultrasound would show if the fetus' brain is growing at a normal rate or if its development has been stopped. If the diagnosis is made after the baby is born, the doctor measures the circumference of the newborn's head and relates this measurement to population values organized by sex and age. The diagnostic measurement for microcephaly is below 2 standard deviations below the average (Boston Children's Hospital, 2017). Because the reference charts that are used to compare the measurements to are taken before 24 hours of age, the head circumference measurements by the doctor should be done within these first hours of life. Another tool used to see the develop of the newborn baby's brain is to take a Magnetic Resonance Image (MRI) of the infant's brain to determine if the newborn baby had an infection during the pregnancy and to see if the development of the brain is normal.

There is no known cure for microcephaly because the brain damage done before birth is permanent. Microcephaly is a lifelong condition and because it can range from mild to severe, the treatment options can vary as well. Treatment for mild microcephaly involves routine check-ups performed on the baby to monitor its growth and development. Treatment for severe microcephaly includes developmental services in the child's life to help to improve their physical and intellectual abilities as they grow up. These types of services can include occupational therapy, physical therapy, and speech therapy. Medications can also be used to control seizures and other symptoms that can coexist with microcephaly.

When the number of Zika cases spiked in 2015, the number of microcephaly cases spiked as well. To make this correlation, it is important to understand what Zika is and how it can cause an underdevelopment in the brain in a developing fetus. Zika is a type of virus that is spread by contact with the *Aedes egypti* mosquito (McNeil, D., 2016). Zika can be spread in a variety of ways, some of which are: having sex with a person who has Zika, a pregnant woman passing it to her fetus during pregnancy or birth, or by blood transfusion. Once Zika is spread to an individual, these symptoms may develop: fever, rash headache, joint pain, conjunctivitis, and muscle pain. If an individual does develop symptoms, they can last for up to a week. A majority of those who are infected with Zika can have very mild symptoms or experience no symptoms at all.

It is important for an individual who thinks they could have contracted the virus to get tested for it. Zika can remain in the blood of a person for about a week (McNeil, D., 2016**).** To get tested, a person will have to go to the doctor and get a blood test. If a person does test positive for Zika, then he or she is likely to be protected from future infections. A pregnant woman should get tested if she traveled to an area with a risk of Zika, if she had sex with someone who lived or traveled to one of those areas, if she lives in an area that has a risk of Zika, or if she began experiencing symptoms **(**Centers for Disease Control, 2016**).**

There is no vaccine for the Zika virus, however, it can be beneficial to treat the symptoms. It is important to get plenty of rest, drink lots of fluid, and take acetaminophen to reduce any fever or pain. It is not recommended to take any kind of NSAID until Dengue is ruled out in a blood test because it can increase the risk of bleeding. If an individual is taking care of someone with Zika, he or she should not touch any blood or bodily fluids with exposed skin, wash his or her hands with soap and water after providing care, and remove and wash any clothes with blood or bodily fluids on them. Along with looking at the treatment of Zika, it is important to look at ways to prevent the virus as well. Preventive measures can include wearing long-sleeved shirts and long pants, staying in places with air conditioning and windows and door screens, treating clothing with permethrin, and using EPA insect repellants. (Zika Virus, 2017). Pregnant women should be extra cautious when it comes to working to prevent Zika. They should use insect repellent that is safe for them, they should not travel to any areas with a risk of Zika, and they should postpone traveling to cautionary areas in the U.S.

With an understanding of microcephaly and Zika, a connection can now be drawn between the two. Congenital Zika syndrome is a unique pattern of birth defects found among fetuses and babies infected with Zika virus during pregnancy. This syndrome has five distinct features: severe microcephaly where the skull has partially collapsed, decreased brain tissue with a specific pattern of brain damage, damage to the back of the eye, limited range of motion in the joints, and too much muscle tone, which restricts body movement after birth (Centers for Disease Control, 2016). Not every child who has this syndrome has these features and not all pregnant women who have the Zika virus have babies with microcephaly, although it does increase their chances. To infiltrate a cell, Zika needs the presence of AXL receptor tyrosine kinase (AXL). The AXL cells cover stem cells in the developing brain and in cells that form the blood vessels that make their way into the brain and neural cells **(**Greenwood, V., 2016). Neural stem cells are particularly vulnerable to the Zika virus, whereas mature neural cells are not.

Fisher and DeRisi researched the way in which Zika is able to enter neural stem cells. They took brain slices from fetuses and placentas from first and second trimester pregnancies. These brain slices are representative of the "battleground" between the Zika virus and the fetus. They exposed the samples to Zika for 24 hours and then proceeded to add a fluorescent tag that attaches to the virus. The researchers also took the placenta and looked at whether the cells would pick up the Zika virus. The cells from placenta did show traces of the virus in them and therefore were deemed vulnerable to Zika. From this the researchers determined that the first trimester is the time where the fetus will be more susceptible to Zika than the second semester. The researchers then went back to the brain cells and looked at which types of cells picked up the virus and whether they have AXL receptors. The virus ended up getting into the neural stem cells in various area of the brain and infected a few neurons, which they attributed to the neurons descending from infected stem cells. The virus also infected the astrocytes, which guide the neurons' growth and transport nutrients around the brain. A molecule was added to some of the cells to block the AXL receptors to see if this kept the virus out and it did. Overall, fewer stem cells mean fewer neurons are developed and this leads to smaller brains. Many infected astrocytes can cause mature neuron death. There are still more questions that need to be answered from this research. For example, why is it that Dengue uses the same AXL receptors to enter cells, but does not cause the birth defects that Zika does. This could be attributed to the fact that the AXL receptors only allow specific conditions to enter, such as: mother's genes, the state of the mother's immune system, or if the mother has had the infection before. Fisher and DeRisi also put cells infected with Zika in a dish and treated them with different drugs. They found that Azirthromysoin stopped the virus from multiplying and it is a drug that is safe for pregnant women (Greenwood, V., 2016).

With a connection established between Zika and microcephaly, the spike of microcephaly cases in Brazil in 2015 can now be discussed. Because some of the poorer populations in Brazil live in areas with open gutters and piles of wet garbage, they are more prone to getting the

Zika virus. Living in these areas in Brazil gives them more exposure to mosquitoes, particularly *Aedes egypti* mosquitos. This population also tends not to be vaccinated against rubella, live in an area where feral cats roam, have the potential to be poisoned by industrial chemicals, and suffer from malnourishment, therefore, these factors also put them at a higher risk for contracting Zika. They are also less likely to give birth in a hospital. The surge in Brazil was more prominent in other South American and Asian countries because it took place in a hospital (McNeil, D., 2016). These other countries are not as developed and most births occur on the floor in the home. A typical Brazilian community has unfinished houses, windows with no screens, no climate control, flat roofs where water gathers, dirt side streets where water pools and attracts mosquitos. The locations where some Brazilian residents choose to live also tends to have poor foundations for housing. These locations are typically chosen because the residents need to live as close to work as possible. This need to live near work to keep their job overpowers the need to live in sanitary housing conditions and these inadequate social and economic conditions can create the ideal environment for an epidemic to occur (Gupta, S., 2016).

The surge of Zika in Brazil was first discovered in May of 2015, although, it was introduced to Brazil in July of 2014 at the World Cup. Seventy percent of all Zika-related microcephaly cases in Brazil resulted from the first wave of infections of 2015. This first wave began on January 1, 2015 in the northeastern part of Brazil and affected 49.9 out of 10,000 live births, compared to typical 2-12 out of 10,000 live births. The second wave was a lot smaller and it began on November 12, 2016 and dispersed across the whole country for a total of 3.2-15 out of 10,000 live births. There were 1,950 cases of Zika-related cases of microcephaly in 2015-2016 in Brazil (Soucheray, S., 2017).

Many of the mothers who were affected by Zika in Brazil brought their babies with microcephaly to a hospital in Brazil and the babies were given therapy. Doctors would do things like put glasses on the babies multiple times throughout the day to try to get them to open their

eyes, dangle black and white toys in front to them to try to elicit excitement, and cover balloons with shaving cream to encourage the babies to use their senses and help develop their brain. One doctor commented, "I am quickly drawn to 7-month-old baby Julia, a chubby darling with wide brown eyes. She seems to be sitting up straighter, and managing to hold her head up higher than other babies in the room. It's a skill they should have all mastered by three months of age" **(**Gupta, S., 2016). This doctor was one that was working with the babies with microcephaly in a hospital in Brazil and highlights how slow the development can be for a baby with microcephaly, but how therapy can help them develop typical skills for their age.

Overall, Zika has been shown to be responsible for some of the microcephaly cases across the world. In the years 2015-2016, Zika particularly surged in Brazil and caused an influx in the amount of microcephaly cases. Zika is the only virus that can cross the placenta and cause birth defects. The reason for this is still unknown, but the virus has been shown the get in through the AXL receptors on the fetus's neural stem cells. If the fetus's neural stem cells are dying, then they will have a smaller sized head. Brazil is more susceptible to this virus because of the conditions the poorer populations live in. There is no cure for Zika or microcephaly, but preventative measures can be taken to avoid both.

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Associations Between Social Media and Well-Being and Sleep Quality in Medical and Health Professions.

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Abstract

This study was conducted to assess associations between social media use and overall well-being and sleep quality in medical and health professions graduate students. A cross-sectional survey was distributed to examine demographic information, social media use, and health behaviors and outcomes. Logistic regression analysis was conducted to examine the relationships between sleep quality and potential covariates and/or independent variables, while proportional odds regression was performed to analyze potential associations between emotional well-being and independent variables. Survey respondents were more likely to have a low or depressed mood if they used social media as a way to help them sleep [odds ratio=2.1, 95% confidence interval = (1.0, 4.2)]. Participants who used social media to help them sleep also had poorer sleep quality than those who did not use social media for that purpose [odds ratio=2.3, 95% confidence interval= (1.1, 4.7)]. In addition,