

- Area: Biology
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- Background:

Zika virus is a member of the flavivirus family which includes other flaviviruses that cause dengue, yellow fever, and West Nile fever. It is transmitted to humans by many Aedes-type mosquitoes, primarily the Aedes aegypti mosquitoes. An infected pregnant woman can become a source of transmission of virus to her baby during pregnancy and can result in serious birth defects, including microcephaly. The outbreak emerged in 2014 in Brazil and the emergence still persists and continues to be the major cause of mortality in many subtropical and tropical countries.

- Importance of Topic:

The outbreak in 2016 showed that Zikas easily missed symptoms may give no indication of its potentially serious complications. There is, currently, no treatment for Zika infection through travel to the mosquito borne regions and sexual transmission continue to be the primary arena where the infection can be controlled.

Women of childbearing age, who contract the virus, are at risk of giving birth to children with severe health problems including microcephaly, eye problems (including vision loss), epilepsy, nervous system defects, and hearing defects.

Of 1450 children born to infected mothers, 1 in 7 had a birth defect associated with the virus or a neurological abnormality possibly linked to the virus [1].

- Inference:

We can formulate a Zika disease transmission model using two approaches, a deterministic model and a continuous-time Markov chain (CTMC) stochastic model. The basic reproduction ratio is constructed from a deterministic model. The CTMC model yields an estimate of the likelihood of extinction and outbreaks of Zika virus. Also the transmission of virus and the person getting sick does not occur at discrete time intervals. To study this uncertainty, we will use the CTMC stochastic model which helps us determine the rate and pattern at any time interval irrespective of discrete intervals and previous processes.

Considering the realistic and fixed scenario, the number of cases and patients will be discrete and finite over a time period. In this case, a Markov Chain model with discrete number of individuals is a realistic choice. Thus, discrete random variables help us build the model better than continuous in an ODE model.

- References:

1. SALOMAN, L. (2018). Zika: Where Are We Now?. [online] ContagionLive. Available at: <https://www.contagionlive.com/publications/contagion/2018/october/zika-where-are-we-now> [Accessed 13 Feb. 2019].
2. Zevika, Mona, and Edy Soewono. Deterministic and Stochastic CTMC Models from Zika Disease Transmission. Stability of Plane Couette Flow of Carreau Fluids Past a Deformable Solid at Arbitrary Reynolds Numbers: Physics of Fluids: Vol 30, No 7, AIP Publishing LLC, 6 Mar. 2018, aip.scitation.org/doi/10.1063/1.5026095.
3. Zika Virus. National Institute of Allergy and Infectious Diseases, U.S. Department of Health and Human Services, 7 Feb. 2019, www.niaid.nih.gov/diseases-conditions/zika-virus.