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Mathematical analysis of sensitive parameters on the dynamical spread of HIV

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Abstract

In this paper, sensitivity analysis was performed on a mathematical model of Human Immunodeficiency Virus (HIV) purposely to determine the parameters that has a pronounced effect on the basic reproduction number in the dynamical spread of the lenti virus. It was established that there exists total disease extinction whenever the basic reproduction is less than unity and disease persists and spread out if otherwise . The relative sensitivity analysis of the parameters related to the basic reproduction number was computed and it was revealed that effective contact with HIV infected individuals and progression rate from HIV to full blown AIDS are the most sensitive parameters in the basic reproduction number. Thus, the result obtained suggests that medical practitioners and policy health makers should give critical attention to parameters that has a pronounced effect on the basic reproduction number.

Keywords: HIV, Sensitivity Analysis, Basic Reproduction number

Introduction: Human Immunodeficiency Virus is a lenti virus which has been proven to be the etiological agent accountable for the Acquired Immunodeficiency Syndrome (AIDS). Since the inception of the epidemic, it has been and continues to be a major public health challenge, having claimed more than 35 million lives so far. In 2017, approximately 36.9 million people were living with HIV with 1.8 million people becoming infected and 940,000 people died from HIV related causes globally. In the same year 2017, 1 million people died of AIDS related illnesses and 21.7 million people had access to treatment. Human Immunodeficiency Virus (HIV) severely weakens the body immune system by attacking the T lymphocytes cells which are typically white blood cells that is believed to clear off invading microbes. In a healthy normal individual's bloodstream peripheral, the T cells level is in between 800 and , which when this number falls below in HIV infected patients, such patients will then be classified as having Acquired Immune Deficiency Syndrome (AIDS). HIV infects some other cell and weak the largest part of the T-cells and this causes destruction and decline in the T-cells and hence, reducing the confrontation of the susceptible system. Human Immunodeficiency virus is found in saliva, tear and urine of an infected individual but the levels of the virus on these fluids are very minute in number. Myriads of researches had been carried out in the field of epidemiology in order to study the dynamical spread of Human Immunodeficiency Syndrome (HIV). The transmission of Human Immunodeficiency Virus (HIV) that causes Acquired Immunodeficiency Syndrome (AIDS) which is strongly associated with defenseless sex; it was made known that the present understanding of this epidemic will reach a higher prevalence threshold level when there are extensive sexual contacts between the sex workers and the general population.

Conclusion

HIV or Human Immunodeficiency Virus attacks the immune system of the human body by targeting the CD4T-Lymphocyte cells. There is no specific medicine to cure people infected with the virus but there are few preventive measures used in curtailing the dynamical spread of the life threatening infection. However, early diagnosis and effective management of the infective individuals with the aid of sensitization and use of ART treatment will prevent the infected individuals from progressing to full blown AIDS stage.

In this article, a mathematical model to understand the sensitivity analysis of some epidemiological features of the dynamics of HIV has been developed. The mathematical analysis that shows the sensitivity analysis of the model has shown that the effective contact rate and transition rate between infected compartments should be minimized.

Biography:

Abimdabe S.F. is currently working in Department of Statistics and Mathematical Sciences, Kwara State University, Nigeria

Speaker Publications:

1. "Optimal control analysis of a tuberculosis model with exogenous re-infection and incomplete treatment". Optimal Control Applications and Methods. Published on Aug 2020.
2. "NUMERICAL STUDY OF FORCED CONVECTIVE HEAT GENERATION FLOW THROUGH A PERMEABLE WALLS WITH SUCTION/INJECTION". International Journal of Scientific and Research Publications, Volume 9, Issue 6, Published in June 2019.
3. "Effect of Magnetic Fields on the Boundary Layer Flow of Heat Transfer with Variable Viscosity in the Presence of Thermal Radiation". International Journal of Scientific and Research Publications, IJSRP, Volume 9, Issue 5, May 2019 Edition [ISSN 2250-3153].

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