World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:18, No:01, 2024

Dynamic Modelling of Hepatitis B Patient Using Sihar Model

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Abstract : Hepatitis is the inflammation of the liver tissue that can cause whiteness of the eyes (Jaundice), lack of appetite, vomiting, tiredness, abdominal pain, diarrhea. Hepatitis is acute if it resolves within 6 months and chronic if it last longer than 6 months. Acute hepatitis can resolve on its own, lead to chronic hepatitis or rarely result in acute liver failure. Chronic hepatitis may lead to scarring of the liver (Cirrhosis), liver failure and liver cancer. Modelling Hepatitis B may become necessary in order to reduce its spread. So, dynamic SIR model can be used. This model consists of a system of three coupled non-linear ordinary differential equation which does not have an explicit formula solution. It is an epidemiological model used to predict the dynamics of infectious disease by categorizing the population into three possible compartments. In this study, a five-compartment dynamic model of Hepatitis B disease was proposed and developed by adding control measure of sensitizing the public called awareness. All the mathematical and statistical formulation of the model, especially the general equilibrium of the model, was derived, including the nonlinear least square estimators. The initial parameters of the model were derived using nonlinear least square embedded in R code. The result study shows that the proportion of Hepatitis B patient in the study population is 1.4 per 1,000,000 populations. The estimated Hepatitis B induced death rate is 0.0108, meaning that 1.08% of the infected individuals die of the disease. The reproduction number of Hepatitis B diseases in Nigeria is 6.0, meaning that one individual can infect more than 6.0 people. The effect of sensitizing the public on the basic reproduction number is significant as the reproduction number is reduced. The study therefore recommends that programme should be designed by government and non-governmental organization to sensitize the entire Nigeria population in order to reduce cases of Hepatitis B disease among the citizens.

Keywords : hepatitis B, modelling, non-linear ordinary differential equation, sihar model, sensitization
Conference Title : ICESAS 2024 : International Conference on Educational Statistics and Assessment Systems
Conference Location : Dubai, United Arab Emirates
Conference Dates : January 18-19, 2024