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A MATHEMATICAL ANALYSIS FOR CONTROLLING THE SPREAD OF HIV/AIDS WITH INDUCED DEATH

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ABSTRACT

We present a non-linear mathematical Susceptible-Exposed-Infective-Removed (SEIR) model which analyzes the spread and control of HIV /AIDS with induced death rate. The basic reproductive number R_0 to the parameters in the model was calculated. Comprehensive mathematical techniques are used to analyze the model steady states. We analyzed SEIR model with natural birth and death rates and with HIV/AIDS induced death rates. We derived the formula for the basic reproduction number $R_0 = \frac{\varepsilon\beta N(t)}{(\varepsilon+\mu+d_2)(\gamma+\mu+d_3)}$ which depends on six parameters and the population size $N(t)$. Using real data collected from Bale Robe town in 2015 year we found that the basic reproduction number $R_0 = 1.14487$. This shows that the basic reproduction number is greater than one which in principle implies that the HIV/AIDS spreads in Bale Robe town. To control the spread of HIV/AIDS we then identify the control parameter which gives insight to decrease or stop its spread. The basic control parameter that can decrease the spread of the disease is the rate of transmission from susceptible class into infected class is $\beta = 0.024874$. Therefore to keep the basic reproduction number is less than one the parameter β should be less than $\frac{0.021725}{N} = 3.9194 \times 10^{-7}$. Other control parameters are also investigated and how they affect the basic reproduction number to be less than one also discussed in detail in their sub sections. We also investigate the disease free equilibrium point and disease present equilibrium point and we have discussed their local and global stability analysis using Ruth –Hurwitz stability criterion.

KEYWORDS: SEIR Model, Four Dimensional System, Reproduction Number, Local and Global Stability

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