
St. Xavier's College (Autonomous), Kolkata

# Deterministic Epidemic Modelling

# HIV/AIDS

## Synopsis for B.Sc. final year Dissertation

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## Introduction

Since the diagnosis of the first AIDS case in 1981 in Los Angeles, California, the AIDS epidemic has grown by dangerous proportions. Since the disease doesn't have any cure yet, it's hard to contain the disease or decrease the no. of infected population. So, in this paper we try to analyse an epidemic model on HIV/AIDS with great depth and try to provide steps to control the disease from more spreading.

## Objectives

- Acquire appropriate and actual epidemiological data sets for HIV/AIDS from past years records and trends

- On the basis of the available data sets
  - Study the past outbreak of the disease
  - Reconstruct and analyse the epidemic model under study
  - Make estimates of potential outbreak casualties for new initial conditions and modern outbreak controls

- Relate these outbreak casualty estimates and look for preventive measures to avoid such fates and fight against it.

## Epidemic Model Overview

In this model we've used the most direct approach to predicting AIDS cases using HIV transmission dynamic models. We've divided the population into five compartments i. e., Susceptible, Infected, Treated, Full Blown AIDS and Immune to

HIV. We then calculate the invariant region, basic reproduction number, existence of endemic equilibrium points, disease-free equilibrium and their stability. We estimate the values of different parameters of the model by past years data, calculate $R_0$ for different values of $r_1$ and $r_2$ and formulated a non-linear mathematical model. We then do numerical simulation with our available data and fit the model with graphs and analyse it.

## Scope and Limitation of the Study

Our present model offers a new approach to look into the epidemic HIV/AIDS from a dynamical approach. This study is important to look for strategic ways to counter and reduce the spread of HIV/AIDS virus with restricted supply. Since we can't totally cure HIV/AIDS our only hope is to get it under control.

Though our model is ideally good with certain data sets, it's not always full proof for all kinds of different environments. The model highly depends on the parameters under consideration and it changes depending on the time, climate and such stuff. Also, the data might change from time to time causing the model to also change over time.

## Concluding Comments

In this paper we've proposed one of the many dynamic models possible for the disease HIV/AIDS and analyse the model, visualize the numerical simulations using python3. We've used past AIDS data collected from WHO and estimated the parameters with that. Using this model, we can tell the future trend of the disease HIV/AIDS which should help health care planners to put some actions in motion and avoid any major HIV/AIDS outbreak in the future. That way the infected number of populations will be differed from our predicted number as time progress and we would be able to successfully control the dangerous HIV/AIDS.