

## Epidemiology is Study of Disease in a Population in Particular

<sup>1</sup>J. Joseph Edward Michale , <sup>2</sup>M.Ramesh Kumar

<sup>1</sup>M.Phil Research Scholar,<sup>2</sup>Asst.Professor in Maths

Department of Maths,Prist University, Puducherry, India

### Abstract:

Epidemic means the infectious disease, which spreads quickly through a large part of the population. The disease rapidly reached epidemic proportions; the health authorities are taking steps to prevent an epidemic of cholera.

There are various tools to gain the comprehensive overview of Non-linear dynamics like Cellular Automata, Epidemic model, SIR model, SIS model etc. We shift the center of focus from general systems to specific medical analysis within the Mathematical framework.

To study Epidemic models, we have to convert SIR model into Cellular Automata model for the disease growth. We propose the models for studying Epidemic disease. This Cellular Automata and Epidemic models are used to support the current Biological thinking.

### Introduction:

The study of Epidemics has a long history with a vast variety of models and explanation for the spread and cause of epidemic outbreaks. Even today they are often attributed to evil spirits or displeased gods. AIDS (acquired immuno deficiency syndrome), the epidemic of the 1980's and probably of the 20<sup>th</sup> century, has been ascribed by many as a punishment sent by God. Hippocrates(459-377 BC), in his essay on 'Airs, Water and Localities' wrote that one's temperament, personal habits and environment were important factors - not unreasonable even today. Somewhat less relevant, but not without its moments of humour, is Alexander Howe's(1865) book in which he sets out his 'Laws of pestilence' in 31 propositions of which of the following, propositions 2, is typical: 'The length of interval between successive periodic visitations corresponds with the period of a single revolution of the lunar node, and a double revolution of the lunar apse time'.

Epidemic means the infectious disease, which spreads quickly through a large part of the population. The disease rapidly reached epidemic proportions; the health authorities are taking steps to prevent an epidemic of cholera. In this chapter and the

following, we shall describe some models for the population dynamics of disease agents and spatio – temporal spread of infections. We can try to exploit them in the control, or ideally the eradication, of the disease (or) infection we are considering. The practical use of such model must rely heavily on the realism put into the models. As usual, this does not mean the inclusion of all possible effects, but rather the incorporation in the model mechanisms, in as simple a way as possible, what appear to be a major components. One such case study is the model proposed by Capasso and Paveri – Fontana (1979) for the 1973 cholera epidemic in Bari in southern Italy. Model can be extremely useful in giving reasoned estimates for the level of vaccination for the control of directly transmitted infectious diseases: see, For example, Anderson and May (1982a,1985,1986). The theoretical papers on epidemic models by Kermack and McKendrick (1927,1932,1933) have had a major influence in the development of mathematical models: we describe one of these in simple epidemic models. The modeling literature is now extensive. A good introduction and survey of the variety of problems and models for the spread and

control of infectious diseases are given, for example, by the books by Bailey (1975) and Hoppensteadt (1975) on mathematical models, the survey by Wickwire (1977) and the collection of articles on the population dynamics of infectious diseases edited by Anderson (1982).

In this thesis we discuss several models, which incorporate some general aspects of epidemiological modeling of disease transmission and the time development of epidemics.

There are basically two broad types of model. In one the total population is taken to be approximately constant with, for example, the population divided into Susceptible, infected and immune groups: other grouping are also possible, depending on the disease.

We discuss models in this category in simple epidemic model. In the other, the disease via the birth rate, mortality, affects the population size. Host – parasite interacting populations often come into this category. We discuss one such model later in this chapter.

### **Epidemiology**

Epidemiology is STUDY OF DISEASE IN A POPULATION in particular how they spread and how they can be controlled.

Epidemiology traditionally is the description of Epidemics, which are occurrences of diseases that significantly affect various groups of people. It studies such factors as an illness attack rate, which describes the number of people ill in a population at risk of being ill. Historically, epidemiology had been applied to studies of INFECTIOUS DISEASES, but in more recent times epidemiologists have also studied major non-infectious diseases, such as cancer and heart disease and other important health problems.

In 1854, John snow investigated and described an epidemic of cholera in London, which he determined resulted from contaminated water from one well. Show's investigation of the cholera epidemic occurred years before the identification of the bacillus that causes cholera.

More recently, epidemiologic studies in detailed descriptions of hepatitis, Lassa fever, Legionnaires disease, and toxic shock syndromes before their causative agents were identified. The correlation between smoking and lung cancer was obtained from epidemiologic studies, as well. Much epidemiological research is now devoted to AIDS.

Epidemiology involves various techniques, the foremost being the descriptive approach, in which the disease (or) situation is defined in terms of time, place and person. Long – term and short – term trends in the occurrence of the disease are considered.

### **Conclusion:**

In the above discussion, we have studied SIR and SIS models for the spread of disease. We have also interpreted SIR model into cellular automata to review essential characteristic of the epidemic.

In fact, any disease can be modeled using SIR, SIS and various interpretations can be given by modeling them in appropriate way. The potential uses of the epidemic study include design and testing of appropriate measures like different vaccination strategies some times the fixed population can be partitioned into sub populations and applying strategies for different sub populations can reduce infection. Sometimes we adopt Bayesian technique and Monte Carlo algorithm to suppress the disease. The Ultimate goal of the study is to deduce the relevant characteristic of epidemic spread from a statistical description of the spatio-temporal contact patterns. That is, we implement proper structure contact intensity. A wide

publicity through TV films etc. can be given so that every one in the population knows the awareness of the disease. Also through the same media the preventive measures can also be given to reduce the intensity of the spread of the disease. The understanding and control of infectious disease is of considerable importance to society. Message can be spread how a disease spread and/or how infectious a disease is as tremendous implication upon the health and wealth of a community.

So many models exist such as Reed – Frost model, critical model, non-critical model and so on. Any one of the models can be applied and infection rate can be considerably by applying any one of the above models. To control epidemics, we can reduce transmissibility that is, we can develop vaccines, we allow people to use barrier contraceptives and we can also request public to use anti-retroviral.

Measure can be taken to decrease mean contact rate such as isolation, Quarantine, health education programs. We can also reduce the length of the infectious period by therapeutics, antibiotic treatment of bacterial infections, care of ulcerations. Hence, the study of epidemic model has become essential in a thickly populated India, wherein any type of disease can affect the population at any time.

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