CHAPTER NO. 1

INTRODUCTION:

"He who wishes to study the art of healing must first and foremost observe the seasons and influence each and every one of them exercises and further he shall take note of warm and cold winds and the properties of water and type of soil and also the way of life which most pleases the inhabitants, whether they are given to wine, good living and effeminacy or lovers of bodily exercises, industrious have good appetite and are sober" (Hippocrates - 460-370 B.C.)

This was stated by Hippocrates, who is often described as the 'Father of medicine' in his book, "Airs, Water and Places". Greeks were the first to give new directions to the medical thought. They attributed diseases to disturbance of bodily "humours" caused by climatic and atmospheric changes.

This can be considered as the first step to prove the relationship between medical science and geography.

At present, medical geography has been used as an aetiological research tool with emphasis on reducing mankind's load of suffering from ill-health. The common interest of medical geography is to locate the environmental factors causing human ill-health.
Medical geography is a scientific discipline combining medicine with geography. Medical geography is often equated with geographical pathology, medical ecology and disease ecology. Medical geography considers disease as a maladjustment to environment to which numerous factors contributes, and so disease becomes an anthropological phenomenon with geographical distribution.

The object of medical geography is the systematic study of the geographical distribution of diseases and of related environmental phenomena.

The approach of the medical geographer to the study of disease, involves:

1) Mapping the distribution of diseases;

2) An examination and description of the patterns of distribution and assessment of the statistical significance of the distribution;

3) Tracing the occurrence of a disease and its apparent association with specific environmental factors. It correlates:

   i) Water supply and cholera infectious hepatitis;

   ii) Atmospheric pollution and chronic bronchitis, lung cancer;

   iii) Type of soil and endemic goitre, hook worm.
Medical geography, thus is concerned with the distribution of diseases and their relationship with physical and social environmental factors.

The scope of medical geography is confined to the study of epidemiology which is defined as "the study of the distribution and determinants of the disease prevalence in man" (Mc Mohan, S. 1960). Modern epidemiology is concerned with the study the health of the human population in relation to their environment. So in medical geography, the problem of human ill-health is related to five basic questions.

1) When does the disease occur? (Time distribution).

2) Where does the disease occur? (Space distribution).

3) Who are affected? (Age and Sex distribution).

4) Why does it occur? (Cause/ive Factors) and

5) How the disease can be prevented? (Preventive measures).

First three questions relate to the distribution of diseases in the human population, the fourth question relates to the search for the underlying causes and the final question deals with prevention of diseases.
Truly, there is no agreed definition of health. Widely accepted definition of health is given by the World Health Organization (1948) which states:

"Health is a state of complete physical, mental and social well-being and not merely an absence of disease."

There are no fixed standards governing health. The standards of health vary from person to person and from country to country. The health of an individual is a dynamic phenomenon. It fluctuates within a range, varying from optimum well-being to extreme illness. The lowest point on the health spectrum is the state of death and the highest points corresponds to the definition given by World Health Organization of health. So, the individual's health is never static. The health is defined as, "a flexible state of body and mind which may be described in terms of a range within which a person may sway from the condition wherein he is at the peak of enjoyment of physical, mental and emotional experiences having regard to environment, age, sex and other biological characteristics due to the operation of internal or external stimuli and can regain that position without outside aid" (Park, 1970).
The health is like a pendulum oscillating between a range of spectrum, one end of which represents the minimum and the other the maximum health condition. It indicates that health is a 'state' not to be attained once and for all but ever to be renewed. (figure 1.)

**DETERMINANTS OF HEALTH**

Individual and group health is determined by

1) Human biology,
2) Environment,
3) Way of living,
4) Economic status and
5) Health services.

Among these, medical geography is confined to all the factors except human biology. The external environment of men is the aggregate of all the external conditions which affect the development and life of an individual. These environmental factors can be grouped into three such as:

1) Physical environment, such as water, air, sunlight, climate, seasons, soil, housing facilities, facilities for excrete disposal and other waste.

2) Biological environment, such as plants, animals, insects and the micro-organisms that surrounds men. The nutrition also is included in biological environment.
FIG. 1.1

THE HEALTH-SICKNESS SPECTRUM
(Adapted from Preventive and Social Medicine by J. E. PARK and K. PARK.)
3) Social environment, such as customs and culture of society, income, occupation, religion and standard of living of man. Health is deeply related to life style such as way of living, personal hygiene, habits, behaviour and health knowledge. Economic status is another important determinant of community health. Although, poverty never appears on a death certificate, it is the most important cause of mortality. Poverty destroys the stability of the family and it is mainly responsible for delays in seeking treatment, poor nutrition conjucted living. All these factors make disease more likely to occur and less likely to be cured. The community health is influenced by the quality and availability of health services. The medical care influences the incidence or prevalence of a particular disease.

Previous Literature:

The earliest works in medical geography in India in the latter half of 19th century and early 20th century were concentrated with distribution and study of diseases on a descriptive basis. Medical geography in the northern parts of India was studied by Mr. Clelland (1859), Mr. Camara (1880), Chevers (1886), Zeans (1888), and Hamoston (1905).
Some type of descriptive works were carried in South India on public health at district level by Hesterlow (1930), George and Webster (1934), Ramchandra (1937), Shivaramayya (1938) and Nityanandan (1941).

The distribution and epidemiology of cholera and malaria have been the most widely researched topics. The cholera epidemic was first conceptualised within a frame work which allowed such factors as the influx of pilgrims at different fairs and festivals were examined in detail. (Rogers, 1944). On the same line, the factors relating to the epidemiology of cholera were well established by Russel (1928) and by Benerjee (1951). Malaria incidence too was analysed at different regional levels by Rao (1930), Russell and Ramchandra (1940). Work on cancer distribution was carried by Orr. (1933), Gault (1955) and Sharma (1958).

The most widely studied aspect of medical geography in India has traditionally been the incidence and distribution of diseases. Work on cancer by Indrapal (1956), yellow water in parts of Uttar Pradesh by Indrapal (1968) and on trachoma by Indrapal (1970) are the classic examples of the traditional studies. In Bengal, work of cholera incidence gained greater importance. These studies were carried by Sen (1957) and by Basu (1969). Goitre was widely studied by Akther (1978, 1979) in the Kumaon region of Himalayas, by Krishnamachari (1974)
in Maharashtra. In the latter parts of 1970's, another centre of medical geography was established at Madras, where cholera incidence at the state and city level was studied by Hyman and Ramesh (1976, 1977) and by Kumarswamy (1981).

The works on malaria ranges in scale from national level studies by Learmonth (1957) to state and micro-level studies by Nair and Samostre (1969). Colonization in new areas along the foothill zones of Terai and dam or reservoir sites and its impact on malaria incidence was highlighted by Akther (1979) and by Hyman and Ramesh (1980).

In addition to malaria and cholera, medical geographers have shown interest in the incidence of other diseases. Occurrence of dengue fever by Joshi and Deshpence (1972) and by Jusetz (1975). Tuberculosis in different towns was surveyed by Bishit (1981) and by Kumarswami (1981). Small-pox was analysed with correlations on a regional basis by Singh and Dutta (1981).

A number of Ph.D. theses indicate the same pattern of studies of incidence and spread of diseases, Singh and Singh (1980), Pandurkar (1981), Akther (1981), Rehman (1981). All these deal with a specific disease at a state level.
Apart from the incidence of diseases a lot of work has been carried by medical geographers in the fields of disease ecology, nutrition environment and health, health care delivery systems and community and social medicine. The geographic study of health-care delivery system in India has so far only a limited literature. Most of the work has appeared only during the 1970s. Spatial distribution and growth of health facilities in Rajasthan and Maharashtra have been examined by Akhtar (1978) and by Shinde (1980) respectively. The spatial distribution of public health facilities in urban Tamilnadu by Ramesh (1981) the efficient location of health facilities in Madras City by Kumar and Jayapal (1981). Problems of redistribution of health services in rural Upper Bhima Basin by Job (1981) are among the works in this field. Mehadev and Thangamani (1981) have assessed policy issues and their implication in the provision of rural health services. The interaction of various systems of health care in India has been assessed by Banerjee (1980). Till today, research done in medical geography can be classified as,

1) Geography of nutrition;
2) Disease ecology;
3) Socio-cultural aspects of health;
4) Health behaviour and traditional medicine;
5) Health care geography and
6) Geography and family planning programmes.
PURPOSE OF THE STUDY:

A lot of work has been carried by medical geographers in India, but most of the work is confined to a state level. Though it has its own importance, for micro-level planning, it is necessary to select smaller administrative division such as a district. Hence, Pune district was selected to study the impact of the environmental factors on the occurrence and on the spread of some important diseases.

The main purpose was to test the model developed by Leavell and Clark, 1958 (Adopted from Health Services Reports, Vol.87, 1958). (Figure 2.) wherein the epidemiological concept of interaction of Agents, Host and Environment was explained. In this model, it is indicated that Agent, Host and the Environment are separate and they are to be treated separately.

The hypothesis put forth by them was, "occurrence of any disease is the combined effect of three factors such as (1) Agent, (2) Host and (3) Environment".

In medical sciences, more thrust is given on 'Agent' and 'Host'. The 'Environment' factors are neglected. So, the attempt has been made to establish that "by studying environmental factors, the agent (the carrier) can be controlled and the host can be freed from diseases".
Epidemiological Concept of Interaction of the Agent, Host and Environment

Fig. No12
The objectives to test this hypothesis are as follows:

1) To study the physical and social environmental factors of the study area.

2) To study the spatial distribution and seasonal variation of the important diseases in the study area.

3) To study the correlation between the spatial distribution of diseases and the environmental factors.

4) To suggest preventive measures against the important diseases.

**Methodology**

**A) Division of the Study Area**

Pune district was divided into 24 units. Each unit is a region served by one Primary Health Centre. Each Primary Health Centre (P.H.C.) covers roughly 35 villages and about 30,000 population. In Pune district, on the basis of population, in some tehsils, there is only one P.H.C. and in some, two or three P.H.Cs. Each P.H.C. is taken as the basic unit; as the data is based on P.H.C.'s records.
B) **Selection and Measurement of Variables for Study**

To find out the correlation between the environmental factors and spatial distribution of diseases, the following variables were selected.

1) **Altitude,**
2) **Rainfall,**
3) **Proportion of rural population,**
4) **Density of population,**
5) **Proportion of literates,**
6) **Proportion of villages getting protected water supply,**
7) **Proportion of Scheduled Castes and Scheduled Tribes to the total population.**

Using Out Patients Departments' Reports, the following diseases were selected on the basis of maximum reported cases for analysis:

1) **Dysentery,**
2) **Measles,**
3) **Malaria,**
4) **Diphtheria,**
5) **Tuberculosis, (T.B.),**
6) **Leprosy and Avitaminosis.**
C) **COLLECTION OF DATA:**

The secondary data at the district level was collected from:

1) *Medical Reports of Pune Zilla Parishad.*

2) Out Patient Departments' Reports and case papers of the patients from the P.H.C.s. were used to collect the data from the basic units. Ten years data (1971 to 1980) was collected for understanding the average conditions of the occurrence and spread of the diseases in all the P.H.C. areas of the district.

3) *Socio-economic Review and Census Hand Books* of Pune district were used.

The primary data was collected from the sample villages by using questionnaire (Appendix I) and by interviewing the doctors in the P.H.C. and the households in the sample villages.

D) **STATISTICAL ANALYSIS:**

Statistical analysis was mainly used to evaluate the relationship between the selected environmental parameters and the spatial distribution of the selected diseases in the district. By using correlation coefficient method, the positive or negative correlation of the environmental factors with the disease was found out.
Further, the data matrix was divided into two sets, (1) Criteria variables, i.e. diseases, and (2) Predictors variables, i.e. environmental parameters. (Appendix III). These two sets were used to carry out canonical correlation analysis (Appendix II) to bring out the relationship between a set of environmental parameters and a particular disease. The scores of the analysis have been used to indicate the estimated spatial pattern of incidence of a particular disease and accordingly, the maps have been prepared. For the comparison, between the estimated and actual, the maps have been prepared to indicate the actual spatial distribution of a particular disease in the district.

Further, the Location Quotient Method is used to understand spatial variation in the occurrence of the important diseases. (Appendix III).

SELECTION OF THE STUDY AREA

To observe the impact of various physical and social environmental factors on the occurrence and spread of some important diseases, Pune District of Maharashtra State has been selected.

With total geographical area of 15,640 Sq.Kms and 4,162,284 population (1981 Census), Pune District has many contrasting factors of the environment.
The western part of this district is occupied by western ghats which run from North to South. The Central and the Eastern parts are flat. The variation in the altitude is from 1200 meters in the West to 600 meters in the East. South-west monsoon rainfall is maximum in the West (250 cm.) and it declines upto 49 cms. in the East. The important rivers of this district originates in the West (namely, Shina, Indrayeni, Nira) and they flow to the East. River Shina in the North and River Nira form the Northern and Southern boundary of the district.

From the viewpoint of the social environment, many variations are observed. The average density of population of the district is 203 persons per Sq.Km. The density of population varies from 82 persons per Sq.Km. in the West to 250 persons per Sq.Km. in the Central plain region. The literacy percentage of this district is 44.62, it varies between 14.4 percent in the West and 65.12 percent in the Central plain region. The proportion of Scheduled Tribe and Scheduled Castes in the district is 3.64 percent. In the Western parts, it is more than 15 percent, while in the Central and Eastern plain regions, it is less than 5 percent. Lakes, tanks, rivers and wells are the main sources of drinking water. In the Western hilly region, most of the people consume water from the lakes (namely, Valwan, Pawana villages from Nawal tehsil) and from the rivers
while in the Central and Eastern parts together with the rivers, well water is consumed. It is important because chlorination of water is possible in case of wells only, so comparatively the Central and the Eastern regions get safe drinking water than the Western region.

The transportation facilities are well-developed in the Central and Eastern plains, but due to steep slopes and rough topography, there are very few all weather roads in the Western parts. The allocation of Primary Health Centres is made on the basis of population to be served. Because of higher density of population in the Central and in the Eastern regions, each Primary Health Centre has to cover an area of 100 to 120 Sq.Kms. (A Circle of 5.6 Kms. radius), while in the Western hilly regions, where the density of population is low (ranging between 80 and 100 persons per Sq.Km.), each Primary Health Centre has to cover an area of 250 to 300 Sq.Km. (A Circle of 9.6 Kms. radius). So, in the Western region, people have to cross the average distance of 10 Kms. to reach the nearest Primary Health Centre and in the Central and Eastern region, the average distance is 5 to 6 Kms. Moreover, it is not the distance only but the type of roads, a frequency of buses and the rough topography, in the West, need more time to cross this distance (between 1 and 2 hours by bus, by carts and for walkers, it is more than 4 hours).
In the Central and Eastern regions, the topography is plain, the roads are reasonably good and the frequency of buses is higher than that in the Western regions. So, the average time required to reach the nearest Primary Health Centre is less than 15 minutes by bus and by carts and for walkers, it is about 30 minutes only.

If the agro-climatic variations are considered, this district has marked variation in the landuse patterns. Due to rough topography, and thin soil cover with heavy South-West monsoon rainfall, the Western region has higher proportion of food crops mainly rice and jowar while in the Central and Eastern plain regions, having good, thick fertile soil cover with the help of canal irrigation, have developed commercial farming mainly cotton, sugarcane, onions. The change in the type of crops, determines the standard of living, the Western region has very low standard of living which causes most of the deficiency diseases, while in the Central and Eastern regions, the standard of living is better and on an average, the people are economically sound, so the proportion of deficiency diseases is less in these regions.
With all these marked changes in the physical and social environment, Pune district provides an ideal geographical region for analysing the effects of the environmental factors on the occurrence and spread of the diseases and hence, Pune district has been selected, for the purpose of this study.

ARRANGEMENT OF THE TEXT

The present work has been divided into seven chapters.

In the first chapter, the subject matter and the study area has been introduced.

In the second chapter, the physical set up of the study area has been explained.

The third chapter explains the socio-economic environment of the study area.

The fourth chapter deals with the environmental factors and health.

In the fifth chapter, the impact of the environmental factors on the disease distribution has been shown.

The sixth chapter gives the causal relationship of occurrence of the diseases and physico-social parameters.

In the last chapter (seventh), the review of the findings has been given and suggestions are made to prevent the common diseases.