

## ENVIRONMENTAL INFLUENCES ON THE WATER-BORNE DISEASES: AN OVERVIEW

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### ABSTRACT

*Disease may be taken as some degree of failure by the organism to challenges posed by the internal or external environments or both. Among populations, the degree of failure to adjust to some of these challenges is reflected crudely by morbidity and mortality indices reflect variations in space and time. The spatial distribution of morbidity and mortality is often non-random and many of the variables in the external environment which are hypothesized as challenges to health also follow non-random spatial distributions. Geographical environment which is a complex web of land, air, water and socio-economic conditions of the society is therefore an over-riding factor in the dispersal and diffusion of diseases in a variety of ways and thus needs a careful examination and analysis in portraying the disease distribution patterns in time and space.*

**Keywords:** *Morbidity, Mortality, Spatial Distribution, Geographical Environment.*

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### Introduction

Geographical associations between environment and human health have for long been recognized as a distinct field of study which we call today as aeromedicine or medical geography. From an ecological perspective, human health can be viewed as a state of adjustment by the organism to its own internal environment and to the external environment. The external environment comprises not only the physical and biological realms, but the cultural and socio-economic realms of man as well in which the life-styles of a society are conditioned. The most significant objective in such studies is to isolate and identify those variables in geographic environment which co-vary geographically with disease indices, and which could conceivably be concerned in disease causation. A second objective of help could be to indicate the relative importance of environmental variables external to the organism and those which are internal or constitutional. It is in the ambit of medical geography therefore that studies pertaining to exhibit co-relationships between environment and disease distribution pattern are studied.

Medico-geographical studies, therefore, depict the state of health of population communities in a certain area or region and focus their attention on the affects of physico-geographical, social, economic and occupational aspects of the people in the region.

These factors are of varied nature and often include the topographical, pedological, meteorological, hydrological, biochemical, floral and faunal aspects of natural environment and the economic, cultural, nutritional, biotic and zoonotic aspects of community living. During recent years, quite a large number of geographers have directed their studies to a comprehensive presentation of the health situation of various regions and countries and the nosological principles in describing the endemic and pandemic foci of disease diffusion patterns have been applied. But inspite of these epidemiological studies and the inventions of several curative and therapeutic measures, the disease incidences have not shown shown a downward trend neither on a regional nor on a global scale. This speaks about the lack of preventive measures and the total paucity of dissemination of knowledge about health and hygiene in the common people which is so essential to mitigate the miseries of the people on account of ill-health.

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### Sources of Data

There is an utter paucity of data on vital statistics in India and so also in Rajasthan. The health data for the entire country is published in the Health Information India Book every year by the Central Bureau of Health Intelligence, Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India, New Delhi. This handbook gives information about the Population Statistics, Vital Statistics, Socio-Economic Indicators, Patterns of Expenditure on Health, Targets and Achievements under different Health Programmes, Medical and Para- Medical Education, Health-Man Power Statistics, Medical Care Statistics, Community Health Services, Public Health Statistics, Causes of Death Data and some special programmes on an all-India basis. Among the variety of data given, vital statistics data pertaining to birth-rate, death-rate, growth-rate of population, infant mortality rates, age-specific death-rates and sex-specific death-rates are of interest and importance to medical geographers. Similarly, the data on medical-care is useful to ascertain the availability of hospitals, dispensaries, public health centres and indoor beds on an all-India level and also on the State level. But the data on the cause of deaths by specific diseases is quite inadequate because it gives only the total number of deaths which has occurred in the various hospitals and government medical centres. The number of such deaths is only a small percentage of total deaths which occur in the rural India as most of the patients of rural areas either do not report themselves even in severe illness or they go away from the hospitals on finding that the disease is incurable. This data is also inadequate in regard to the state-wise and district-wise break up and so spatial variations cannot be deciphered morbidity conditions and from it. The data in regard to the incidence rates is also insufficient. Firstly, it does not give the state-wise and district-wise break-ups to explore the areal differentiations. Secondly, it does not give the incidence-rates of specific diseases according to various age-groups so as to ascertain the causal effects of these diseases and their virulence in the various age-groups. Thirdly, this data is given only for a few diseases which are very common like diarrhoea, dysentery, fevers, tetanus, accidents, cholera, measles etc. which may be of different be of different types and may have different causal relationships in various areas. Nonetheless, the data obtained from this source has been used in the present work for making comparisons on all India scale.

The data on Rajasthan and its various its various districts has been obtained from the Directory of Institutions 1987-88, published by the Directorate of Medical Health & Family Welfare Services, Government of Rajasthan, Jaipur. It is a useful compilation showing the number of hospitals, dispensaries, primary health centres and other types of medical centres in all the districts and tehsils of the State. But it does not mention the vital statistics and the incidence of various diseases in the state.

The required data on the disease incidence had therefore to be collected from the official records of the Vital Statistics, Division of the Directorate of Medical, Health & Family Welfare. Yearly records about every disease from every Government Medical Centre are sent to the Directorate. This data of all the medical centres of the study region was obtained from the Directorate for the last 5 years and the averages were found out. These averages of individual medical centres were grouped into various tehsils and districts of the region.

Data about the age, place of residence and sex are not available even with the Directorate and SO field surveys were done in the endemic areas of every disease to generate these data for use in the present work.

The data in regard to climatic elements has been obtained from the Department of Irrigation, Government of Rajasthan and the Indian Meteorological Department, Government of India. The data in respect of forest distribution has been obtained from the Rajasthan Forest Statistics, Forest Department Jaipur. Data on agriculture landuse, yields, irrigation, livestock, industries and minerals has been obtained from two main sources viz., The Statistical Abstract 1986 and the Statistical Handbooks of every district, both of which are published every year by the Directorate of Economics & Statistics, Government of Rajasthan, Jaipur. The population data in regard to growth, density, literacy, sex-ratio, rural-urban distribution, scheduled caste and scheduled tribe distribution has been obtained from the Census Reports 1981 which are published for the entire State as well as for every district by the Directorate of Census Operations, Government of India. The data regarding ground water resources and the chemical and physical properties of water has been obtained from the Ground Water Board, Government of Rajasthan. This data has frequently been supplemented by field surveys whenever there was a need for it. Quite frequently, various books, monographs, dissertations and other reference material has been consulted in the present study which has been acknowledged at appropriate places.

### Methodology

The present study is based upon both the cartographical and statistical techniques. Empirical studies and field observations have also greatly influenced the write-up of the text in the present work. Future population growth of every district and tehsil has been calculated by the following formula (Component Method)-

$$P_t + Q = P_t + (bP_t + I_m) - (dP_t + O_m)$$

where  $P_t$  is the population at any point of time

$b$  is the birth-rate

$d$  is the death-rate

$I_m$  is the In-migration and

$O_m$  is the Out-migration

The age-adjusted death-rate of individual diseases has been calculated by the following formula.

Where the expression  $nM_x$  is the mortality rate at the age  $x$  for the any administrative unit and  $nPx^s$  is the number of persons in the equivalent age group of a standard population,  $s$ . The standard population is usually the national group for a specified time.

The Standardized Mortality Ratio (SMR) has been calculated by the following formula.

where  $D$  is the number of expected deaths on the basis of age- specific death-rate in a standard population;

- the expression  $nM_x$  is the existing mortality rate at age  $x$  for any state, and standard population; which is mostly the entire
- the expression  $nPx$  is the number of persons in the equivalent age group for any administrative unit at age  $x$ , in question.

Thus the Standardized Mortality Ratio expresses the relative mortality in various administrative units as a percentage of the national rate, the national rate being set at 100. The same formula can also be used for Standardized Morbidity Ratios for various administrative units.

The clustering of diseases and tehsils in regard to the rates has been done by multi-variate analysis. The incidence formula used is -

where  $r_K$  denotes the rank coefficient of correlation

$D$  refers to the differences of ranks between paired items in two series, and

$N$  are the number of observations.

The results obtained by multiple correlation matrix have been extremely useful in determining the similarity and variations of disease incidence rates in relation to the topographical, climatic and socio-economic similarities and dis-similarities of various tehsils and districts which are even far apart in their location. This method is of great help in analysing the endemic areas of various diseases and their diffusion processes in various parts of the region through space and time.

It was essential in the present work to analyse the distribution of health-care centres in the region because the reporting's of various diseases is invariably done at these centres. Optimal location of medical centres both in regard to the population load on each centre and the minimum distance covered by the patients to reach the nearest health centre is important. In Rajasthan, the average range of medical centres in rural areas is 172/km<sup>2</sup> and the average population load per medical centre is 13,565, which is very high as compared to the urban areas of the State. As the study area in the present work is most diversified in regard to the topography, climate and natural variables and consequently in respect to the population growth and density also, it was essential to study the existing health facilities. It has often been observed in Rajasthan that regardless of the needs of the population for health-care centres their location is determined by political factors. In the present study only those medical centres have been included which are run and financed by the State and Central Government. It is only sporadically that one may find a big hospital or dispensary run by some philanthropist or some private entrepreneur. As the number of such medical centres is very less, it has been assumed that the reportings of patients at such centres will not affect the incidence-rate of diseases to a large extent.

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