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GEO-MEDICAL ASPECTS OF ACUTE DIARRHOEAL DISEASES IN MEGHALAYA

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Abstract

Environment and diarrhea is a complex and multidimensional topic. An unhealthy environment is the main reason for its causation in the community, however not much effort is made to understand and improve the condition. The incidence of this disease is primarily related to the hot season, poor environmental sanitation and low quality potable water. Hence diarrhea, among other common communicable diseases, is seen as the index of public health condition. The Meghalaya, a North Eastern Indian state, is a plateau landmass with a unique bio-cultural diversity in the world's wettest climate. The huge majority of the population is mostly scheduled tribes living in rural areas (81.4%) and of which only half is covered under the institutional health care delivery. As expected it offers a wide range of disease environments, dominated by communicable diseases (35.68%). Recent observations (1994, 1996) revealed that Acute Diarrhoeal Disease ranked highest in most of the districts with the highest prevalence rate of 225 cases per thousand in the Ri Bhoi against the state average of 104 cases. In general higher temperature, lower altitude and high density of population induced higher prevalence. Late summer and early rainy season are the peak periods of incidence throughout the state. The present paper attempts an insight into the pattern of prevalence of the Acute Diarrhoeal Diseases over the geo-cultural extent of the state to understand the latent environmental factors involved.

Introduction

Environment and diarrhoeal disease occurrence is a complex multi-dimensional topic mainly for the medical geographers and epidemiologists. In the global perspective diarrhoea is rivalled only by respiratory infections as the most common cause of morbidity. In the tropical belt 15% – 40% of all under 5 years children die due to diarrhoea related diseases. Thus it is a major public health problem in all developing countries and distinctly so in India. A current estimation shows that in India 32.3% of all hospital admissions were due to Diarrhoea compared to 13.6% due to Acute Respiratory Infection (ARI) and that the proportion of death was 16.7% and 13% respectively. There were 6.27 lakh deaths annually which included 20% child population.

Diarrhoeal Disease Environment

The term diarrhoeal diseases should be considered only as a convenient expression for a group of diastases due to intestinal infections in which the predominant symptom is diarrhoea. WHO/UNICEF define acute diarrhoea as an attack of sudden onset which usually lasts 3-7 days but may last up to 10-14 days (Park, K. 1997).

Unhealthy environment is the main culprit for causation in the community, however not many efforts are made to understand and improve the condition and yet the key to the prevention and control lies in the environment as a whole and in specific situations. The incidence of these diseases is directly related to the hot season, poor environmental sanitation and the quality of water. The faecal/oral route through food and fomites often spreads infections caused by a variety of diarrhoeagenic enteropathogens. Flies and cockroaches are important vectors (probably mechanical) in warm climate countries. A temperature of 25 °C or more is suitable for faster breeding of these insects (Park, K 1997).

As a primary barrier of transmission of organisms causing diarrhoea, the system of safe disposal of excreta is emphasised e.g. its collection, transportation, treatment and disposal. On the other hand, improvement of awareness of water sanitation behaviour results in prevention of a diarrhoeal epidemic (Esrey S. A et al, 1985 cited by Dutta , P. 1999). Cruickshank (1976) observed that the incidence was highest amongst those who had no easy access to water for personal ablutions and lowest among those with water within their domicile.

The Problem Statement

The Meghalaya Plateau is one of the oldest landmasses in India possessing a uique bio-cultural diversity under the subtropical monsoon climate. Perceptible variation in altitude, rainfall, temperature etc. helps in developing a wide range of disease environments. Two distinct physiographic regions have been identified in Meghalaya as follows:

1) The Eastern Meghalaya shares almost 60% of area and four out of seven districts of the State and is commonly called the Khasi Hills. Here the central plateau ridge slopes down towards the Assam and Bangladesh plains on the north and south respectively with the altitude ranging from above 1600 m. to 50 m. Therefore, this region possesses a higher spatial variation of rainfall and temperature. Notably the rainfall character changes sharply from the Cherrapunjee - Mawsynram belt over southern slopes to the rain shadow area on the northern slopes.

2) The Western Meghalaya or the Garo Hills, on the other hand has a lower average altitude with low rounded hills and intermittent plains. The central plateau ridge culminates here reaching the Nokrek peak (1411 m.) near Tura. Relatively higher temperature and lower rainfall prevail here with lesser variations over space. Thus the Garo tribesmen with more cultivable land and higher population density are culturally distinctive to the Khasi people in general (Figure-1).

The huge majority of population (81.4%) live in rural areas and are mostly dependent on a traditional mode of agriculture – the *jhum* cultivation. The high growth rate of population (32.9%) exerts extra pressure on the already deforested and degraded soils of the hill slopes. The National Family Health Survey report (1993) showed that one out of every twelve children dies before reaching the age of five. In fact only 10% of all children are fully vaccinated and 55% do not receive any health care.

On the other hand, almost half of the rural population (42.3%) is not yet covered under the institutional health care network. Considering all the government and private hospitals, only one bed was available per thousand populations (Govt. of Meghalaya, 1994). The Executive Summary Report (1994) of the Directorate of Health Services, Government of Meghalaya showed that diseases related to natural environment (mainly water born) as well as of communicable nature dominated (35.68%) compared to all India rate (20.80%). Diseases of respiratory track infections (including pneumonia) and intestinal infectious diseases like diarrhoea, dysentery, gastroenteritis, etc. are the two main groups prevalent all over Meghalaya. Deficiency diseases like anaemia and blindness are also of great importance followed by skin disease and dental problems. On the other hand Meghalaya, particularly Garo Hills and Jaintia Hills are major Malaria endemic zones. At present malaria especially P. Falciparum has emerged as the most concerned causes of health hazards throughout the state.

Moreover, certain stringent traditional customs of the tribal groups like the Garo, the Khasi and the Jaintia debar them from the benefit of the modern medicine wherever available. Though the estimates of vital indices of tribal population of India are grossly inadequate, their general health status is rated comparatively poorer than its non-tribal counterpart. Widespread poverty, illiteracy, malnutrition, a hostile environment, absence of sanitary living conditions, ignorance of the cause of diseases, lack of health services or inability to seek and use them are only some of the many possible contributing factors for the deplorable health conditions prevailing among the tribal groups (Ali, 1991). Thus the overall health status of any tribal community is the manifestation of several interrelated factors including the natural habitat, genetic and hereditary elements, cultural and behavioral aspects, traditional perception of health and disease as well as the level of acceptance of the modern health care delivery. In general communicable diseases showed a remarkably high proportion (35.68%) in Meghalaya compared to all disease morbidity which were higher again compared to all India rate of 20.8%. Among the seven districts of Meghalaya, diarrhoeal diseases ranked first in five and second only in East Khasi Hills and Ri Bhoi alternatively with acute respiratory infections (Mukherjee, S and D. K. Nayak, 1998). During the study period (1994-1996) the average annual prevalence of diarrhoeal diseases war 78.66 cases per thousand populations in the state.

Materials and Method

Institutional records on month wise reported cases of all diseases have been used as basic data. Data on diarrhoea morbidity have been compiled from the 80 Primary and Community Health Centres scattered over 30 Community Development blocks of seven districts of Meghalaya for the period of 1994 to 1996. The three year average of the diarrhoea morbidity has been worked out to find spatial prevalence patterns and

corresponding environmental control factors. The available figures on altitude, rainfall and temperature were collected from secondary sources and have been interpolated and extrapolated up to the block level. Correlation coefficient between pairs of variables has been calculated to test the level of association of each set. A field investigation was conducted in all the seven districts and certain high-risk areas to assess the micro situations as well. Within the limits of the present paper an attempt has been made to understand the macro situation with respect to the Diarrhoeal Disease occurrence over state Meghalya as a whole. Simple statistical methods and techniques have been applied which were mapped using ArcView GIS software.

To understand the distribution patterns over the Meghalaya proportion of the reported diarrhoea cases to all diseases as well as incidence per thousand population per year have been worked out and depicted in maps taking C. D. Blocks as the lowest unit. The highest proportion of this disease of 39.18% against the state average of 20.57% have been observed in the Nongstoin Block of West Khasi Hill district. Interestingly the lowest value of proportion for the same disease was also observed in the adjacent block Mawshynrut (7.11%). In fact just one third of the C.D. Blocks had diarrhoeal disease percentage lower than the state average of 20.57%.

But the highest incidence of 205 cases (state average 78.60%) was in the Nongpoh Block of Ri Bhoi district. In the Rongram block of West Garo Hill district the lowest incidence of 3.79 per thousand populations occurred.

Seasonality of Diarrhoea

The month wise distribution of diarrhoeal diseases has been shown through line graphs for all the C. D. Blocks grouped in seven sets for seven districts. Primarily there is a high seasonal variation with a higher proportion of diarrhoeal disease cases during the summer and rainy seasons followed by a decreasing trend in winter. Similar trends were reported by Ahmed, M. et al (1995) in their report on diarrhoea among children in Pakistan. The C. D. Blocks of WKH, SGH and JH have shown marked variations within the districts. This probably is the reflection of wide geographical diversity within the districts in terms of altitude, temperature and rain fall. It is further noticeable that lower altitude C. D. Blocks in WGH and SGH districts there are second high season in post rain autumn seasons. On the other hand in higher altitude districts like EKH and WGH monthly distribution patterns showed a strong similar trend. But it is highly noticeable that the Mawshynram and Mawkynrew C. D. Blocks in the world's wettest zone have almost a pyramidal curve with peak in the months of June and July corresponding positively with the rainfall character. The northern most district of Ri Bhoi also showed a symmetrical conical curve with the peaks in rainy season. (Figure-1).

Table- 1

Correlation Coefficient Values between ADD And Climatic Variables

Districts	*Temperature*	*Rainfall*
West Garo Hills	0.75	0.86

South Garo Hills	0.20	0.56
West Khasi Hills	0.84	0.85
East Garo Hills	0.64	0.83
East Khasi Hills	0.84	0.89
Ri Bhoi	0.78	0.89
Jaintia Hills	0.76	0.82

The most significant level of statistical correspondence was observed between the mean monthly distribution of diarrhoeal diseases cases and mean monthly temperature and precipitation. The correlation values for those two climatic elements have been calculated for each of the seven districts. In fact East Khasi Hills, the highest altitude district holding the world's highest rainfall zone showed the highest positive correlation between the seasonality of the climatic element and disease. (Table-1).

Lowest positive values were found in case of the South Garo Hills district where average slope and altitude is lower and under reporting of diseases due to poor health care system is evident.

Table- 2

CORRELATION	Average Altitude	Average Annual Rainfall	Average Annual Temp.	Density of Population
Diarroheal Diseases (%)	**0.150066**	**0.432875**	***- 0.23686***	**0.036631**
Diarroheal Diseases Incidense	**0.003**	**0.050**	***- 0.038***	***- 0.19775***

Results

Examining the correlation coefficient figures it is primarily evident that:

i) A very low level of correspondence is present with the average altitudes of the C. D. Blocks.

ii) A moderately significant positive association with rainfall is found particularly with the percentage distribution of diarrhoeal diseases. Interestingly temperature has a low negative correlation coefficient in both the cases (Table).

A somewhat paradoxical situation was observed during the field investigation. Even in the highest rainfall belt the villages with higher slopes and ridge top location

suffer most from acute water shortage throughout the year and particularly in the dryer months. There is hardly any perennial source left in and around such villages due to deforestation and faulty agriculture. Thus the crisis of water brings down the supply of any water and therefore the level of personal hygiene leading to high diarrhoeal diseases.

The density of population as a disease associate is not found significant. A low negative correlation exists with the incidence rate and very low positive rate with that of percentage distribution. This indicates that higher population density does not necessarily lead to such disease and that the high density urban pockets in the state have a better water supply as well as better hygienic living. Similar observations were made by Brussow, H. et al (1993) in their study on the hilly equatorial country – Equador, where altitude and density of population were not significant associates to the diarrhoeal diseases.

In case of availability of drinking water to the rural population the resulted degree of association is negative as expected. Reasonably higher negative correlation exists between drinking water supply and diarroheal diseases incidence rate. But from the village level field investigation it is understood that the secondary data on this aspect remain far from the reality. In fact water is the most wanted daily need for the majority rural as well as the urban population in the hill environment. In a somewhat similar conditions amongst children of southern Thailand the crude incidence rate of diarroheal diseases among children not using piped water supply was higher than those using it, reported by Chongsuvivatwong, V., et al (1994) in his study. Even in the villages with piped water supply and at a lower altitude zone the situation becomes very much more unhealthy due to flood and water logging during the rainy season e.g. in the parts of Garo Hills and Ri Bhoi district.

Conclusions and Recommendations

In the region of the world's highest rainfall, the water borne diseases, particularly diarrohea, poses a major challenge for management of water resources for the guaranteed supply of safe water to the huge rural population.

To fight back such a huge burden of disease a comprehensive epidemiological data base is the prime need. At present whatever data recorded, processed and preserved are grossly inadequate for this less developed Scheduled Tribe dominated bordering state.

The supply of safe piped water to all villages has to be ensured in an effective manner, for which rain water harvesting system as well as micro catchments reservoirs has a bright prospect in this hilly and inaccessible terrain.

Utilising the already available NIC net connection in all development blocks sudden onset of the disease has to be monitored closely and emergency service needs to be provided.

As a primary barrier of transmission of organisms causing diarrhoea, the system of safe disposal of excreta is emphasised e.g. its collection, transportation, treatment and disposal mainly in the urban pockets and large villages.

On the other hand, improvement in awareness of water sanitation behaviour will result in prevention of diarrhoeal epidemics.

Figure-1

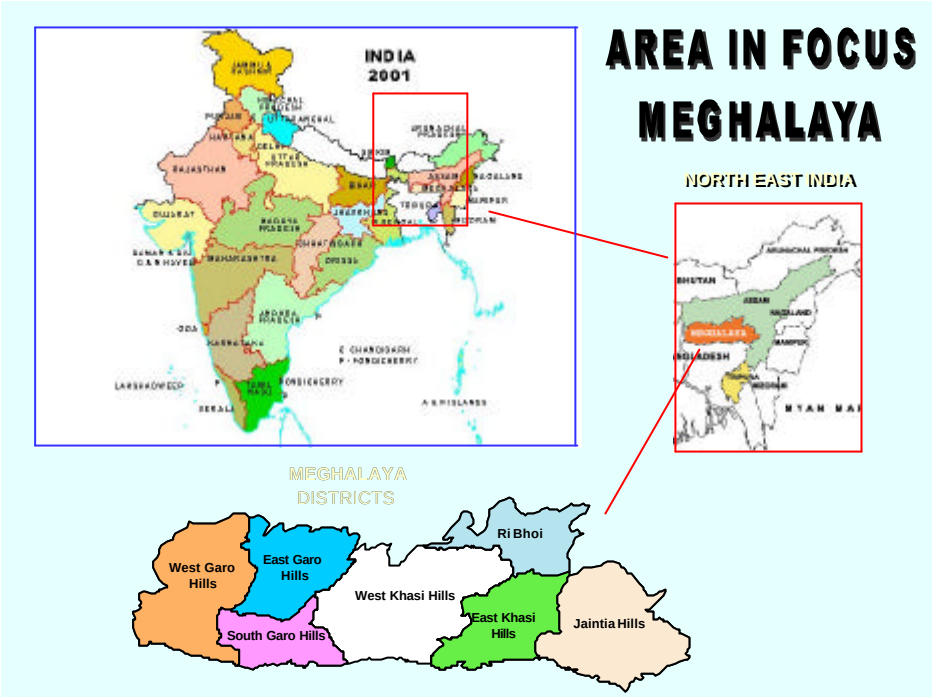
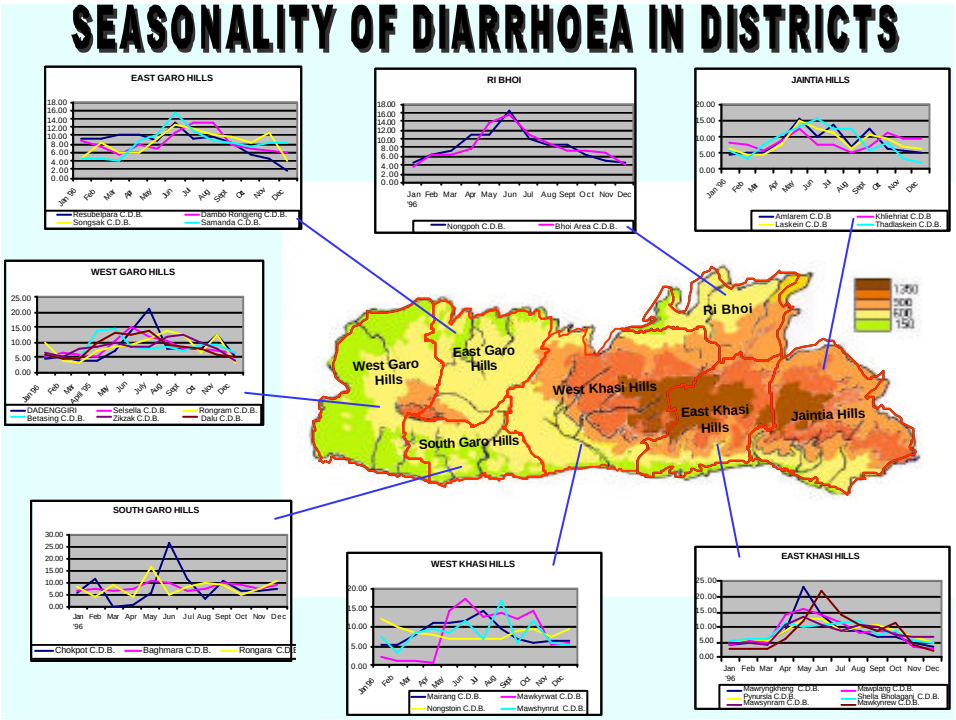


Figure-2



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