# Taking care with GIS: Status and Prospects

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Articles

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*While the developed countries are taking initiatives to establish a well-organised GIS based health care system developing countries are still facing increasingly diverse and complex health problems*

Recently, the United Nation's Human Development Report, 2000 was released which has praised India's human rights endeavours. In the same report, it has also been stated that the health profile of the country is disturbing. Totally, 4,100,000 people below the age of 50 have HIV/AIDS. In 1997, the country had 275 cases of malaria per 1,000 people as compared to 163 in Thailand. Nearly 16 per cent of Indians are not expected to live to be 40, 44 per cent of adults are illiterate and 25 per cent are without access to proper healthcare. Going through the above statistics as putout by the UNDP, how much satisfaction can we get regarding our country's health?

Have a look at the most neglected parts of India, the rural areas that consist of more than 600 million people in total, but are provided the least infrastructural facilities. Most of the so-called 'rural health centres' are located far away from metalled roads, without electricity, without telecommunication and also without sufficient trained manpower. The medical students at the graduation level have to take the oath as a tradition since the Greek period: "Whatsoever house I enter, there with I so far the benefit of the sick, refraining form all doing and corruption…" Do they keep this oath in future? Not always. The dearth of rural health centres is well-known to the young medical practitioners who forget their oath once they get an offer to serve the rural health centres far away from the sophisticated urban hub. As a result, the rural health centres usually suffer from lack of doctors and any kind of basic medical facilities.

At this stage of medical achievements, when the researchers are creating the map of chromosomes, the doctors are detecting the diseases with the help of computers and the doctors in the US are using 'biochip', many people, especially from rural India die because of unavailability of proper medical facilities. Besides the lack of willingness from the practitioners' side, the paucity of health related data is a major handicap in conducting health studies in underdeveloped countries like ours, having overburden of population

and financial constraints. It is the lack of information that creates a vicious circle between the planning and development processes in the field of health management. The researchers in the field of medical geography may not also avoid their responsibility in that respect.

**If health is wealth**

Geographers have a long history of applying geographical and cartographical analysis techniques to health problems. More than a century ago, epidemiologists and other medical scientists began to explore the potential of maps for understanding the spatial dynamics of disease. Medical geography, or spatial analysis, was taken up in the early 19th century by physicians attempting to understand the relationship between environmental conditions and the occurrence of disease. Dr. John Snow made the hypothesis that cholera might be spread by infected water supplies more than a century ago, using maps to demonstrate in a striking fashion the spatial correlation between cholera deaths and contaminated water supplies in the area of Soho in 1854. But, in India, the studies in the geography of health appear to be confined to studies in the spatial patterning of communicable diseases, especially of diseases like cholera or deficiency diseases particularly those associated with prevailing nutritional/malnutritional levels, whereas the researches in non-communicable diseases are lacking because published data on such diseases are difficult to come by. Therefore, it is very unfortunate that the changing patterns of health associated with hazards of development, demographic transition and changing lifestyles have failed to draw the attention of Indian geographers.

**Looking for a new horizon**

Still now, most texts of health surveillance recommend the use of pins to locate cases of notifiable diseases on a map following the way shown by John Snow long back. A variety of maps of origin-destination data are used to assess referral patterns of cancer patients in the northwestern part of the state of Washington, USA. Several simple area-based cancer maps have been produced in the European countries, on the basis of municipality data. Ecological approach has used incidence data in the municipalities of Finland in evaluation of the effects of the Chernobyl fallout on the risk of childhood leukaemia and also in evaluation of the association between mutagenicity in drinking water and gastrointestinal and urinary tract cancers. A similar methodology has also been applied in the Cancer Atlas of Northern Europe project which covers Finland, Sweden, Norway, Iceland, Denmark, Germany, Poland, Luthuania, Latvia, Estonia, Belarus and western parts of Russia.

The Programme HealthMap was initially created in 1993 as a joint WHO/UNICEF Programme based within the Department of Communicable Diseases to establish a GIS to support management and monitoring of the Guinea Worm Eradication Programme. Both spatial and temporal changes in environmental conditions are important determinants of vector-borne disease transmission. The remote sensing data on climatic conditions, vegetation etc. which are directly or indirectly related to the diseases, are combined with epidemiological data to predict vector occurrences. Satellite imageries are

useful for identifying environmental changes, predicting areas and periods of high transmission. The National Aeronautics and Space Administration (NASA) initiated the Biospheric Monitoring and Disease Prediction Project, the aim of which was to determine the capability of remotely-sensed data in identifying and monitoring environmental factors that influence malaria vector population.

The Centre for Health Applications of Aerospace Related Technologies (CHAART) is a branch of the Earth Science Division at the NASA Ames Research Centre. Since 1985, CHAART has undertaken a number of projects involving the application of remote sensing and geographic information systems technology to human health problems, including studies of Filariasis in the Nile Delta, Lyme Disease in the Northeast US and Schistosomiasis in China. The goal was to develop a hydrologic model that could be used to identify risk factors for disease transmission. The GIS database included topography, irrigation networks and natural drainage systems, demographics, location of residences and work areas, snail habitats and night-soil storage sites, snail population densities, and disease incidence. It was determined that risk was largely dependent on age and housing location.

With the development of the geographic database, models and analysis procedures, the systems are being used as an important research tool for tropical vector-borne diseases. Now, GIS is being introduced to control tropical diseases like sleeping sickness, Chagas disease, Leishmaniasis, schistosomiasis, guinea worm and malaria. A system has been developed in New Zealand for the national control of foot and mouth diseases; it proves how geographic databases and disease epidemiology models can be integrated into a decision support system. The potential application of GIS to health in South Africa can be divided into a macro level and micro level. Both these two levels can be applied to health issues such as the provision of health infrastructure, mapping of disease, investigation of the spatial dynamics of the communicable environmental and infectious disease transmission and also to the modelling of health service utilisation and disease control intervention.

The South Australian Health Commission has prepared the social health atlas of South Australia which aims to ensure that the best possible information is available to the public and those providing health services as to the state of health of South Australians. The second edition of the map, recently released, performs an important role by publishing a wide range of information in an accessible format. One hundred and fifty nine maps in the atlas describe the socioeconomic, health status and health service use characteristics of the South Australian population for postcode areas and Statistical Local Areas in Metropolitan Adelaide and Statistical Local Areas and Health Service Regions in country south Australia. Other maps show the location across the State of a selection of health and welfare services.

Activities under WHO Roll Back Malaria (RBM) initiative have taken shape in Asia. In Nepal, Indonesia, India, Bangladesh, Sri Lanka and the Philippines, situation analyses have been made and future programmes have been prepared for Roll Back Malaria for the year 2000. In some countries, pilot projects for restricted areas are being launched on

a trial basis. Information gained on various aspects of the pilot project implementation including that obtained from implementing partners will be used as a basis for planning in order to move health cares closer to the communities during the implementation of the RBM programmes in the malaria endemic areas.

**Miles to go**

While the developed countries are taking initiatives to establish a well-organised GIS based health care system, the developing countries are still facing increasingly diverse and complex problems mainly due to rapidly growing populations and severe resource constraints. Rational allocation of scarce resources is difficult and is dependent on the size of catchment populations. Expensive hospital-based health care systems are protected by strong vested interests, reorientation is mainly rhetorical, and primary health care is making only slow progress. The formulation of proper GIS faces some constraints which include problems in the flow of information from the field, including delays, non-reporting, non-response, and a generally unsatisfactory quality of generated data from primary sources.

In the countries like India where population is heterogeneous with ethnic, religious and socioeconomic differences influencing illness concepts and demands for health care, the only available information on the local population is the Census of Population, normally conducted every 10 years, which does not coincide with the actual catchment populations served by health facilities. The health information system should reflect these circumstances, but available data are almost exclusively about care-seeking clients and their service utilisation. A need exists for a more precise and complete description of the catchment population and health situation. It is important to generate this information at village, community, and division levels.

The improvement of health scenario must be supported by the proper allocation of spatial and temporal problems of health, map is the foremost necessity, which might get much more accelerated with the support of advanced GIS-based mapping techniques. Studies in geography of health need to adopt a welfare approach in order to improve the quality of life. In this context, the interplay of social, economic and political processes in the inquity and inequality in health care services, the changing environment and the resultant environmental hazards need to be researched intensively to plan for the effective health management strategies in the changing environmental scenario.