September 2010

Technical report

Geographic Information System (GIS) and Public Health: Practice of Good Mapping

Workshop for GIS users
6-8 & 13-15 September 2010

Organized by
National Institute of Epidemiology
(Indian Council of Medical Research)

Funded by
Health system Research Cell (HSRC)
(Indian Council of Medical Research)

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"Geographical Information System (GIS) and Public Health: Practice of good mapping"

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Organized by National Institute of Epidemiology (ICMR)

Venue:
National Institute of Epidemiology (ICMR),
Second Main Road,
Tamil Nadu Housing Board,
Ayapakkam, Ambattur,
Chennai – 600 077.

Funded by
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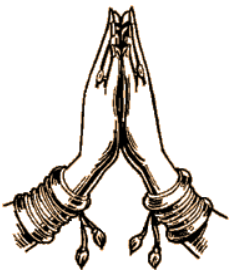

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Message

"Geographic Information System (GIS) provides visualization and analysis of epidemiological data, thus revealing trends, dependencies and interrelationships that would be more difficult to discover in other formats." It provides an excellent means of collecting, updating, managing epidemiological and entomological surveillance and related information. GIS can be effectively utilized to identify areas where a particular disease is prevalent. The technology can be used as location planning for a newly proposed health scheme and resource management. Monitoring and evaluation can be made simple by GIS approach. GIS has long been as a valuable tool for good decision-making. GIS will have greater importance due to its abilities to integrate a wide range of data sources, from legacy systems to image data, and make complex data into easily comprehensible.

As more researchers and agencies are likely to increase their use of GIS, the demand for training, producing good quality maps, creating quality spatial data, networking and data sharing continues to grow. It is apparent that GIS data produced in our country requires streaming to avoid duplication and repetition thus producing and sharing across users is made beneficial and more cost effective. The need for the expansion of professional skills expands. Also the system needs to be reviewed periodically and made aware of the flaw for quality improvement and current requirement and also to make the users aware of new developments. Thus the present workshop is designed to fulfill the gaps between the producers, the users of GIS data in India. I hope the proposed deliberations within next three days by inviting the best available diversified resource persons within our country will fulfill the identified gaps between the users and producers of GIS data in the existing system.

I am sure that this initiative of the National Institute of Epidemiology with financial support by ICMR (HSRC) will strengthen the efforts of researchers and health planners in providing better health care through evidence based strategies.

V. Kumaraswami
Director –In- Charge
National Institute of Epidemiology.
Ayapakkam, Chennai 77.

Executive Summary

Modern tools like Remote Sensing (RS) and Geographical Information Systems (GIS) have now come in handy to address the issues on the disease surveillance, control, monitoring and evaluation. Our responsibility in the immediate future would be to provide good quality of input to these systems and adopt apt procedures in order to facilitate formulation of policy statement and preparation for strategic plans.

The National Institute of Epidemiology (NIE) with financial support from Indian Council of Medical Research (ICMR), Health System Research Cell (HSRC) organized two workshops for Geographic Information System (GIS) users. The workshops were designed to offer comprehensive guidance for those who are using GIS in public health related activity at their work place.

The workshop objectives were to develop automation of Geodatabase from a micro level, promote quality disease maps and effective usage of GIS technology in health research. The participants were from various states of our country, mainly health care providers, practitioners and researchers from Government and non Govt. Organizations, who were actively involved in health research. Experts in Epidemiology, Research Institutions, Colleges, Survey department, Census Operations, Hydrology and Disaster Management who use GIS technology extensively were identified and deliverance of a series of guest lectures were organized. This report summarizes the proceedings of the workshops.

Two spells, each of three days events brought together participants from different institutes as well as external educational experts (GIS) from diverse fields.

Participants felt the workshop as an eye opener to strengthen the quality of geodatabase development at micro level. The expertise experiences were added as a catalyst for deeper involvement in newly emerging techniques and in addressing the improvement of public health problems.

The workshop was an opportunity for participants to conceptualise a common vision for strengthening, capacity building and to disseminate their learning to the betterment of the health.

We appreciate the participant's wishes to have such workshops and exchange experiences to happen again.

- There are growing users of GIS technologists in health research. The Geo communities provide freely accessible GIS software and add on modules - all easy to use. There are also workshops and training programmes conducted at national and international levels using GIS. The learning process is much easy to achieve but when put to practice it is difficult.

  Without adequate data, GIS technology is not useful. Even if the data was available at macro level, acquiring the data at the desired level was a cumbersome process. If micro level data was available for region like wards of a town/city still associated factors at that level was not possible. For example, disease like malaria, ward wise data is possible but factors like breeding sites, water stagnation points etc. is not available. This is true with most of the disease conditions.

  The latest/modified digital maps were not easily available. Data sharing policies not formulated and hence resources are spent more and more in the reinvestigation of same data and maps.

  In some maps, scale accuracy is not mentioned. Sampling methodology applied for data collection is not specified. The automation of digital data is not uniform. Hence results are not comparable and amenable for the macro levels.

  Some of the maps produced by the users were incomplete, lacking even with the minor concerns of map elements. In some instances Dot maps were misleading. In Choropleth maps, class intervals were arbitrarily decided according to the mapmaker's convenience. Modifiable Areal Unit Problem (MAUP) was not well addressed. Spatial temporal mismatches occur in certain disease condition like AIDS, Cancer etc. Spatial dependence is ignored and models are built without accounting for it.

  Scholars and researchers who approached our institute for their internship, project work and thesis dissertation felt handicapped without the disease data and map at the desired level.

For the past one-decade our minds have been pondering over the above thoughts.

In the meantime, there was a published paper based on a summary of discussions about current practices in the spatial analysis of georeferenced cancer data by a panel of experts convened at the National Cancer Institute added an inspiration to us (L W Pickle 2005). Our vague thoughts were brought out clearly and precisely in words by the panel members. This lead to nurturing of the workshop and stream lining our thoughts – thanks to HSRC (ICMR).

- Nearly twenty-six Government /Private organizations/ colleges/research institutes (Annexure2) were approached to identify GIS users in and around Chennai city. The purpose of our visit and the information about the workshops were conveyed. Commonly used GIS softwares, health GIS related studies undertaken, published articles/reports, GIS facilities available at their workstation and their views & limitations using this technology were obtained.

- Among the twenty six institutions, majority (80%) used ArcGIS, 12% used MapInfo and another 8% used freely downloadable software like EpiMap, Health Mapper, MapWindow, QGIS, OpenJUMP and GRASS GIS.

- Ninety nine percent of the institutions visited had a full-fledged GIS Lab/Cell with futuristic planning for hardware and software requirements and on technicalities. Scanners, colour printers and software loaded with a minimum of five to ten users and well trained and qualified personnel were available.

- Almost all the institution has undertaken collaborative studies related to health research and also have published and presented several papers and reports related to their studies. Their published works and views were also taken as an input for the workshop presentations.

- The views of the GIS users are listed in the page (28).

- Experts in Epidemiology, Research Institutions, Colleges, Survey department, Census Operations, Hydrology and Disaster Management who use GIS

technology extensively were identified and deliverance of a series of guest lecture were organized (Annexure4 & 5).

- We organized two workshops during 9-12th Sep'10 and 13-15th Sep'10. The announcement of the workshop was made on 19 July 2010 through our website (NIE) and ICMR website (Annexure3). We had a tremendous response for the workshops. Seventy-six applications were enrolled and a number of phone calls were received for the enrollment. Our target audience was mainly GIS users and Health care providers/ public health practitioners / Researchers from Government and non Govt. Organizations / Institutions actively involved in health research. The participants were screened and informed of their selection on 6th August 2010.

- There were 30 participants, selected from various states like Himachal Pradesh, Madhya Pradesh, Bihar, West Bengal, Maharashtra, Karnataka, Kerala, Tamil Nadu and from Chennai City for the first workshop (Annexure 6).

- There were 24 participants selected from Delhi, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Chennai City for the second workshop (Annexure 7).

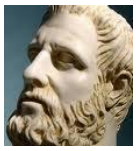
- Vast majority (76%) of the participants were ArcGIS users and the next highest was MapInfo (18%) and a few beginners used other freely available softwares.

- Salient feature of the workshop was some of the guests who delivered lectures were also interested in updating their knowledge and were also among the participants (Dr. T.P Ahluwalia, Dr. Biju Soman and Dr P.Venkatesan).

- In the mission of our endeavour we have completed two workshops and two more to be held in January 2011 with more refined and interesting additional features obtained as feed back from the participants and the lessons learnt from the completed workshops.

INTRODUCTION

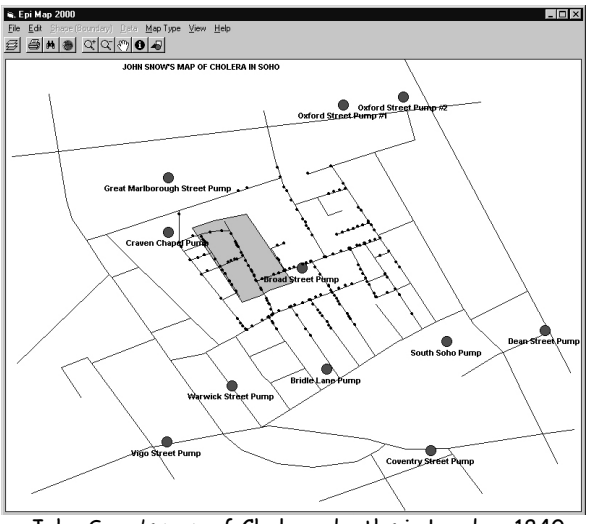
GEOGRAPHIC INFORMATION SYSTEM (GIS) AND PUBLIC HEALTH



The perception that location can influence health is a very old one in western medicine. As far back as the time of Hippocrates (460-370 BC), physicians observed that certain diseases tend to occur in some places. **Hippocrates** was in search of the cause of diseases. He studied about the things such as climate, water, clothing, diet, habits of eating and drinking and in turn the effect they had in caused the disease.

The Hippocratic concept of health and disease stressed the relation between human beings and his environment. The disease diffusion was spread across the geographical regions but pattern of spread was not uniform.

John Snow was a British physician and a leader in the adoption of anaesthesia and medical hygiene. He is considered to be one of the fathers of epidemiology, because of his work in tracing the source of a cholera outbreak in Soho, England, in 1854. It had already taken nearly six hundred lives when Dr John Snow, using a hand-drawn map, showed that the source of the disease was a contaminated water pump. By plotting each known cholera case on a street map of Soho district (where the outbreak took place), Snow could see that the cases occurred almost entirely among those who lived near the Broad Street water pump. Snow recommended that the handle of that pump be removed, and that simple action stopped the outbreak and proved his theory that cholera was transmitted through contaminated drinking water. People's perception that cholera deaths were confined to the area around a cemetery of plague victims was removed and they were convinced that the infection was not due to the burial of plague victims.



John Snow's map of Cholera deaths in London, 1840.

In early 1960s Computer hardware development spurred by nuclear weapon research led to general-purpose computer "mapping" applications. The year 1962 saw the development of the world's first true operational GIS in Ottawa, Ontario, Canada by the federal Department of Forestry and Rural Development. Developed by **Dr. Roger Tomlinson**, it was called the "Canada Geographic Information System" (CGIS) and was used to store, analyze, and manipulate data collected for the Canada Land Inventory (CLI) – an effort to determine the land capability for rural Canada by mapping information about soils, agriculture, recreation, wildlife, waterfowl, forestry, and land use at a scale of 1:50,000. A rating classification factor was also added to permit analysis.

CGIS was the world's first such system and an improvement over "mapping" applications as it provided capabilities for overlay, measurement, and digitizing/scanning. It supported a national coordinate system that spanned the continent, coded lines as "arcs" having a true embedded topology, and it stored the attribute and location information in separate files. As a result of this, Tomlinson has become known as the **"Father of GIS,"** particularly for his use of overlays in promoting the spatial analysis of convergent geographic data.

“GIS provides visualization and analysis of epidemiological data, thus revealing trends, dependencies and interrelationships that would be more difficult to discover in other formats.” GIS provides an excellent means of collecting, updating and managing epidemiological surveillance and related information.

The role of GIS; it can answer questions:

- Can we identify areas where a particular disease is prevalent?
- Can we get some evidence about the possible factors that are responsible for a particular disease?
- Calculates response times for interventions?

- Where to locate a new Primary Health Centre?(location planning)
- Where to provide additional resource facilities and staff? (resource allocation and management)
- Which are the areas wherein water borne diseases are prevalent?
- In which area the infant mortality is high?
- Which are the areas where the literacy rate is low?
- How many persons live within a 10 km of radius of a particular PHC?
- Who are the population affected within 100km of radius due to some natural calamity?

Few of applications of GIS in Epidemiology and public health:

- It gives health professionals quick and easy access to large volumes of data.
- Used to determine health condition of a population in an area for disease surveillance.
- Identification of high-risk groups for a certain disease condition for focused intervention.
- Monitoring, evaluation and intervention of health programmes.
- Estimates of population density for resource allocation.
- Entomological surveillance of vector-borne diseases, such as malaria, dengue.

GIS has been be used in public health for epidemiological studies. By tracking the sources of diseases and the movements of contagions; agencies can respond more effectively to outbreaks of disease by identifying at-risk populations and targeting intervention. GIS can be used to determine patterns or differences in health situations through different levels down to local level. Public health uses of GIS include tracking child immunizations, conducting health policy research, and establishing service areas that need immediate attention. Entomological surveillance of vector-borne diseases, such as malaria, dengue can be made simple with GIS technology.

Inherent in the definition of epidemiology is measurement of 'frequency', 'distribution', and studying 'determinants' of disease. All of this information requires GIS technology to comprehend quickly and take action instantly. Generally physicians and public health professionals measured health strictly in terms of indicators of ill health such as morbidity and mortality. But the practise in Epidemiology, Public Health and Medical Geography is to examine the distribution of disease and death at various geographic scales for determining whether the presence or absence of particular illness is associated with some factor(s) in the social or physical environment. In the case of infectious diseases, there is an added dimension of examining the diffusion of disease through space over a given period of time. By modeling the spatio-temporal incidence/prevalence of disease and related environmental factors, detection of disease clusters and generation of new hypothesis is possible. Although mapping of disease can be relatively straightforward, interpreting spatially referenced disease data can sometimes be challenging.

Apart from the difficulties in data acquisition, map representation, scaling, statistical analysis, and the interpretation and utility of results, the study of disease distribution may well be the most challenging and fascinating research area.

The main objectives of GIS are the management (acquisition, storage and maintenance), analysis (statistical and spatial modelling), and display (graphics and mapping) of geographic data. GIS is a valuable tool to assist in health research, health education, and planning, monitoring and evaluation of health programmes and health systems.

NEED FOR THE WORKSHOP

Healthcare providers are the most important assets to healthcare systems, to ensure high qualities of care to combat diseases. The system needs to be reviewed continuously/ periodically and make aware of the quality improvement and development goals. Geographic Information Systems (GIS) plays a vital role in strengthening the process of health care systems. GIS provides excellent means for visualizing and analysing epidemiological data revealing trends. With GIS technology, Identification of hot spots and disease clusters is simple. Monitoring and management of epidemics will be more effective by GIS tools that would otherwise be more difficult with raw or tabular form. Standardized procedures from the initial stage of data compilation and correct presentation of the data analysis would help to improve the system in full. This would make us possible to compare and contrast the results across the regions effectively.

Objectives of the workshop

- *Quality and promotion of a spatial data set infrastructure at a micro level*
- *Propagation of guidelines in producing good quality disease maps with specification of map accuracy.*
- *Proper usage of the map analysis.*
- *Effective usage of the GIS technology in health research.*

Inappropriate and incomplete procedures would make the results invalid and misleading. Lack of quality and desired / grass route level information limits one to apply sophisticated technologies and for building complex models. This workshop provides an opportunity for the end users to improve the systems delivery to a universally accepted level. It also provides an opportunity to strengthen capacity building and networking.

FREE GIS SOFTWARES RELATED TO HEALTH

EpiMap is a simple easy to use GIS program. It is developed and available to public from the Centers for Disease Control and Prevention (CDC) in collaboration with the World Health Organization (WHO). It is freely available in the public domain for researchers, public health workers etc. [http://www.cdc.gov/epiinfo/].

HealthMapper - The HealthMapper has been designed and developed by WHO specifically for use by public health administrators working at national and district levels. The HealthMapper simplifies the collection, storage, updating, retrieval and analysis of public health data. It simplifies the use of geographic information systems and mapping and provides a user-friendly interface to spatial analysis and data management. It provides the public health user with user-friendly icon-driven functions to automatically create maps, tables and charts of their data; it can be freely down loaded at [http://software.informer.com/getfree-download-health-mapper-4.2/]

CrimeStat III is a spatial statistics program for the analysis of crime incident locations, developed by Ned Levine & Associates under the direction of Ned Levine. It was funded by grants from the National Institute of Justice. The program is Windows-based and interfaces are with most desktop GIS programs. The purpose is to provide supplemental statistical tools to aid law enforcement agencies and criminal justice researchers in their crime mapping efforts. CrimeStat is being used by many police departments around the country as well as by criminal justice and other researchers. It can be freely down loaded at http://www.icpsr.umich.edu/icpsrweb/CRIMESTAT/

GeoDa[TM], a free software program developed by Luc Anselin and The Regents of the University of Illinois and intended to serve as a user-friendly spatial analysis for non-geographic information systems (GIS) specialists. It includes functionality ranging from simple mapping to exploratory data analysis,

the visualization of global and local spatial autocorrelation, and spatial regression. It can freely downloaded at http://geodacenter.asu.edu/ .

SaTScan™ is a free software that analyzes spatial, temporal and space-time data using the spatial, temporal, or space-time scan statistics. It is designed for any of the following interrelated purposes:

- Perform geographical surveillance of disease, to detect spatial or space-time disease clusters, and to see if they are statistically significant.
- Test whether a disease is randomly distributed over space, over time or over space and time.
- Evaluate the statistical significance of disease cluster alarms.
- Perform repeated time-periodic disease surveillance for early detection of disease outbreaks.

The SaTScan™ software was developed by Martin Kulldorff together with Information Management Services Inc. Down loadable at [http://www.satscan.org/].

WinBUGS, is a software for advanced spatial analysis**.** The **Win**dow version of **BUGS** (**B**ayesian inference **U**sing **G**ibbs **S**ampling) is mainly used for the Bayesian analysis of complex statistical models using Markov chain Monte Carlo (MCMC) methods.

The project began in 1989 in the MRC Biostatistics Unit and led initially to the 'Classic' BUGS program, and then onto the WinBUGS software developed jointly with the Imperial College School of Medicine at St Mary's, London. Development now also includes the OpenBUGS project in the University of Helsinki, Finland.

GeoBUGS (BUGS for Geostatistics) has been developed by a team at the Department of Epidemiology and Public Health of Imperial College at St Mary's Hospital London. It is an add-on to WinBUGS that fits spatial models and produces a range of maps as output.

WinBUGS & GeoBUGS can be freely downloaded at

[http://www.mrc-bsu.cam.ac.uk/bugs/winbugs/contents.shtml].

COMMERCIAL SOFTWARES

ArcView/ArcGIS and various extensions

This software is developed by ESRI, Inc. and represents one of the standards in the industry. This software is used extensively by researchers but to a lesser extent by practitioners. There are other companies who provide extensions to this package such as the EpiAnalyst Extension for ArcView. These products have extensive capabilities. However their costs are generally beyond the means of public health departments.

MapInfo

This is also a commercial GIS package developed by MapInfo. This GIS product is also widely used and its cost is less compared to ESRI products; however it does have less capability as some of the ESRI products have.

OPEN SOURCE GIS SOFTWARES

GRASS GIS

Commonly referred to as GRASS, this is free Geographic Information System (GIS) software used for geospatial data management and analysis, image processing, graphics/maps production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world. Also users are many governmental agencies and environmental consulting companies. GRASS is an official project of the Open Source Geospatial Foundation. It can be downloaded at [http://grass.itc.it/]

Quantum GIS (QGIS) Quantum GIS (QGIS) is a user friendly Open Source Geographic Information System licensed under the GNU General Public License.

QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). It can be downloaded at [http://www.qgis.org/]

ILWIS is a user-friendly integrated software with raster processing capabilities to work on remotely sensed satellite images and vector processing capabilities for making vector maps and spatial modeling abilities. It can be downloaded from [http://www.ilwis.org/].

OpenJUMP is an open source Geographic Information System (GIS) written in the Java programming language. It is developed and maintained by a group of volunteers around the globe. OpenJUMP started as JUMP GIS designed by Vivid Solutions. It can be downloaded from [http://www.openjump.org/].

MapWindow GIS desktop application is a free, open source, standards-based standalone software package that can be used to view and edit GIS data in many file formats.

The software includes plug-ins for various geoprocessing tasks (e.g. buffer, merge, etc.), watershed delineation, accessing online data sources, and an experimental geodatabase plug-in. The attribute table editor can be used to write simple queries, and there is a complete scripting editor that allows one to write and run scripts in VB.NET and C# directly in the MapWindow program. It can be downloaded from [http://www.mapwindow.org/]

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Workshop I (6th Sep'10- 8thSep'10)

The photos portray the inaugural function on 6th Sep'10. The dignitaries on the dais seated from the right are Dr. V. Kumaraswami DIC & Scientist F, NIE; Prof. Ramalingam, Director of IRS Anna University; Dr. Jeyaram, General Manager & Project Director**,** Regional Remote Sensing Service Center (East) (ISRO); Dr. V. Selvaraj, Technical officer, compired the inaugural function (agenda enclosed Annexure8).

The invited participants constituted a balance group of GIS users from various states right from Himachal Pradesh in the North down to Kerala in the south. They are health care providers/ public health practitioners/ Researchers from Government and non Govt. Organizations / Institutions actively involved in health research.

Prof.Ramalingam spoke on Public Health Information System using a case study done in Salem district. He explained how a GIS based decision support tool for health management was created and spatial analysis of morbidity using several socio economic variables, incidence of the diseases, location of hospital facility were mapped as multiple layers.

Dr A. Jeyaram enlightened the application of Remote Sensing (RS) and GIS and the uses of Global Positioning System (GPS) in identifying and mapping Sand fly Distribution in endemic and Non-endemic Kala-azar foci in Bihar and Jharkhand. The input data were from satellite imagery IRS LISS III, PAN data (two seasons), Collateral data (administration, disease, etc…) and Ground truth information. Models generated using high risk variables were discussed.

Mr. B.K. Roy briefed on map details and essentials of mapping. He physically showed different maps drawn in field and its digitization, geocoding, projection etc. He spoke on raster data and vector data and their storage format. Features of two main products of digital mapping DTDB (digital topographical database) and DCDB (digital cartographic data base) were explained.

Dr. M. Jagadeesan presented the five main uses of GIS in Public Health Domain namely Disease Mapping and Spatial Analysis, Communicable Disease Control, Environmental Health HealthCare Planning & Policy and Disaster Planning and Response with practical examples of Tamil Nadu Public Health data.

Dr R. Joseph explained macro to micro data management in census operations using GIS. He discussed about the Chronology of GIS usage in census right from 1997 to the upcoming census . Census Info 2.0 modeled out from Devinfo of UNICEF was demonstrated. Their publication of map products and atlas in hard and soft mode were briefed.

Mr. A. Lazar briefed on the hierarchy of Geodatabase for Tamilnadu census operations. Types of Geodatabase and spatial data organization using it were explained. The need for spatial data base and issues during their creation were brought out. The utility of the user friendly application software of Census Info 2.0 for generating customized Tables, Charts and thematic

Maps for State/District/Sub-district level indicators were explained.The Indicators/parameters available from 1901 Census to 2001 Census were listed. The acessability of the MS Access database for India/States/U.T./ District/Sub-District that were available along with the software were informed.

Dr. S. Sabesan shared his 15yrs of experience in the field of mapping. He explained the role of GIS as Mapping of vector borne disease distribution and stratification, Identifying risk zones, space time cluster analysis, Developing early warning system and generating decision-making tools for the control of diseases. The limitations of the available data were discussed. The model predicting filariasis risk named as Geo-environmental risk model (GERM) on GIS platform was explained. The model had been customized by the environmental parameters and Filariasis Transmission Risk Index (FTRI) derived. Based on FTRI values, the area was stratified into potentially at 'risk' or at 'no risk' using GERM.

Dr.Biju Soman described the Participatory approach to GIS mapping for public health. Training were given to women emphasizing Health scenario and trends, managing common ailments, informed existing schemes and facilities, Gender rights and imparting leadership skills. The Centre for Earth Science Studies (CESS) geologists also trained them in making Cadastral maps. Inreturn the trained women generated quality maps and continued to take part in monitoring health related activities.

Mr. M. Devarajan brought out the importance of GIS in disease surveillance stating that the geographical distribution and variation of diseases can be assessed. Gaps in immunizations could be identified, and risk related factors could be assessed, epidemics could be forecasted and the utilization of health facility be evaluated.

Mr.S. Raghavendran talked about the current trends of GIS in disease epidemiology through more interactive, near-real time and dynamic maps. The new trends in GIS were explained by the 3D terrain analysis using Bentley GeoPak Site to understand the natural drainage pattern of a municipal ward to indentify areas prone to water logging . He

emphasized that data is the power. He gave an excellent final thought of the plight of our human race threatened with a plethora of heath related issues in this 21st century.

Dr. P. Venkatesan explained about GIS Based Sampling Methods for Health Surveys. He pointed out three kinds of data necessary for GIS analysis in the context of a health survey namely data coming from demography, questionnaires & biochemical analysis, waypoints collected using GPS and maps of the study area from different sources. This sampling methodology was discussed for a health and air quality survey for the metropolitan city of Delhi and 12 neighbouring districts.

Mr.A. Elangovan demonstrated a new method of estimation of HIV infection using GIS and sentinell surveillance data. He explained the kriging technique in the estimation of prevalence. This method uses the techniques of autocorrelation based on semi-variogram to express the spatial variation. The estimates derived were compared with NACO work book method and NFHSIII data. The new method almost agreed with the other methods.

Dr Vasna Joshua explained the theme of practice of good mapping. The basic map elements needed for a good mapping was discussed. The different types of maps were shown. Various methods used for determining the spatial clusters and their significance was described. A spatial statistical modeling was demonstrated using leprosy vaccine trial data in an endemic region of Tamilnadu,South India.

Dr. V.Kumaraswami explained about the GIS and public health, mainly focussed on the Tuberculosis disease. The GIS applications in epidemiology was discussed based on data Visualisation and exploration, data Integration, monitoring, Geostatistics and modelling, Spatial Interaction &diffusion and data sharing & Web Services. GIS of Model DOTS Area was focused in detail and project outputs displayed.

Dr. Tune Usha made a real time presentation on the importance of GIS in coastal disaster

management. Disaster from a public health point of view was discussed. The Tsunami disasters happened in December 2006 in Tamil Nadu was portrayed. The methodology for studying the coastal hazard was presented which used four technologies namely GIS, Remote Sensing, numerical models and GPS. Finally it was concluded that Natural hazards cannot be prevented; but disasters can be minimized and managed with dew care. She also briefed on how GIS technology can be used to identify the magnitude of inundation in flooding situation.

Mr. Kumaran Narayanaswamy spoke on the open source GIS software for Public Health namely Quantum GIS. The four basic freedoms of a free software were brought out namely the freedom to run the program for any purpose, to study how the program works, and adapt it to our needs, the freedom to redistribute copies with or without modifications and finally the freedom to improve the program, and release improvements to the public, so that the whole community is benefited. He also spoke on the ability of Quantum GIS that performs equally as that of ArcGIS.

The dignitaries and the participants of the first workshop (6th-8thSep'10) in the group photograph at the National Institute of Epidemiology.

Workshop II (13th Sep'10- 15thSep'10)

The dignitaries on the dais during the inaugural function of the second workshop seated from the right are Dr. B.N. Murthy Scientist F, NIE; Dr. V. Kumaraswami DIC & Scientist F, NIE; Dr. T.P. Ahluwalia Scientist F, Chief of HSRC, ICMR HQts; Prof T. Natarajan former Director of IRS, Anna University; Prof. N. Sivagnanam former Head of the Dept. of Geography, Madras University and Dr B. Nagaraju, Scientist F, NIE.

The participants from various states attending the inaugural function from Ujjain in Madhya Pradesh down to Madurai in Tamil Nadu.

Prof. T. Natarajan discussed about the GIS technology utilization prospects and problems. He briefed about Remote Sensing technology, Digital Photogrammetric Mapping System, Digital Elevation Models and mobile Mapping. He also presented about the health application of GIS using examples of various diseases like rift valley fever, dengue and malaria. The advantages and limitations of using GIS were discussed in depth and suggestions were focused.

Prof. Sivagnanam explained about health GIS conceptual and structural aspects. His examples were on dengue and malaria in Chennai city. He also explained that health and welfare demands accounting time-dependent or time controlled spatial patterns. He also discussed the web a enabled GIS model for village information system in a village named Kutikaranpudur in Karur district.

Dr. B. N. Nagpal presented about GIS in decision support of vector borne disease control in India. He discussed about their milestones towards success starting from the year 1994 to 2010. Their study journey started with the disease malaria, Kala azar and dengue using Remote Sensing and GIS technologies. The focus was on intervention & recommendation. He also mentioned about the GIS-based surveillance system that ensures that if a localized outbreak occurs, it can be associated rapidly with a problem of breeding site, a specific anopheles vector, and a probable human source, so that prompt control measures can be most efficiently targeted.

Dr. G.P. Ganapathy discussed about the Historic Disaster Information System for the State of Tamil Nadu. He talked about the general effects of disasters and system of management of the disasters. The current scenario of the Disaster Databases in India was brought out and the limitation in current database explained. Historic Disaster Impact Analysis of Tamil Nadu State with thirty disaster events of 30 years from 1976 to 2006 was demonstrated.

Dr. B. K. Roy spoke about map, geoids, reference coordinate systems and scale of a map. He also talked about various types of maps, map projections, map details and map symbols. He explained the process of digitization, raster data, vector data and two main products of digital mapping DTDB (digital topographical database) and DCDB (digital cartographic data base). The current products of Survey of India (SOI) are OSM (open series maps) based onWGS84 datum and UTM Projection (open for all) and DSM(defense series maps) based on WGS84 datum and LCC projection (mainly for military use).

Dr. Vasna Joshua presented Linked Micro maps (LM) and Conditioned Choropleth (CC) maps using the example of Infant Mortality Rates of India. The features and purpose of both maps were discussed and their utilities were shown. LM plots provide the reader with a tool for rapidly reviewing such statistical concepts as median, inter quartile range, upper adjacent values and outliers. The purpose of CC maps is to help researchers generate hypotheses about observed spatial patterns and move towards advanced statistical analysis. The Quality of data is the key to all maps.

Dr. V. Kumaraswami presented GIS applications in the Public Health related fields. He talked about the spread of Tuberculosis transmission and pathogenesis and its exploring links using GIS technology. He explained about the GIS methodology used in different countries to address the control of Tuberculosis.

Dr. R. Joseph discussed about the geodatabase from macro to sub micro level to be applied in census 2011 Tamil Nadu. He described how the creation of digital database has been decentralized by assigning data conversion work to each of the state directorates. In Tamil Nadu, Digital database for 30 districts consisting of 201 taluks, covering 16317 villages and 832 towns has been created. He elaborated the slum mapping of spatial & non-spatial attributes done in Chennai city using manpower and GPS. He also demonstrated census info 2.0

Dr M. Devarajan talked about inventory of infrastructure in primary schools of Tamil Nadu – an analysis and action plans for improving school sanitation and hygiene education facilities using GIS. The school sanitation and health education status in elementary schools of Tamil Nadu was assessed. The results were portrayed in spatial formats. It was concluded that the health and hygiene program seem to have not only improved the overall hygiene and sanitation standards of children inside and outside the school but also helped indirectly to increase attendance of girl students in schools. The plan has been shared at the national level as a spatial model for all districts targeted by the total sanitation campaign.

Dr S. Raghavendran talked about the GIS based Donor Information System. He mentioned about the current trends and the new trends in GIS technology. He explained Neogeography, a set of techniques and tools that fall outside the domain of traditional GIS. He said that near real-time information on donors will be helpful for better harvesting of organs. He also said it requires robust IT/GIS based operational support system as its backbone to effectively utilize data on donors.

Mr. A. Elangovan talked on estimation of HIV infection using the GIS technology. The locations of HIV sentinel centres of Tamil Nadu were mapped using GIS. He explained how the mapping of location of HIV sentinel survival centres and all the site-specific HIV prevalence rates were transformed into a GIS format. Interpolation techniques were applied and HIV prevalence values for non-sampled location were estimated. HIV infection load were calculated for entire Tamil Nadu. These estimates agreed with that of NACO and NFHS III.

Dr P. Venkatesan presented the GIS based sampling methodology adopted for health and air quality survey done in Delhi. He narrated how the GIS methodology acts as a powerful analytical tool to create and link spatial and descriptive data for problem solving, spatial modeling and presentation of results in tables or maps. He also explained the various steps involved in sampling for health surveys.

Mr. A. Elangovan described about the various application of GIS in public health related activities. He explained the merits of the GIS technology. He said as complex & time-consuming process were made easy, how complex queries can be performed across the database, Highly endemic region can be identified for priority care and identification of high risk factors by overlaying various layers.

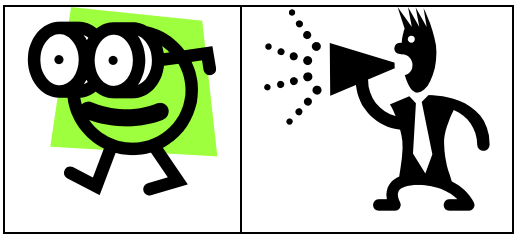
Dr Vasna Joshua explained the theme of practice of good mapping. The basic elements of map were discussed. Different types of maps and their utility were discussed. It was shown how different number of classes & breaks can radically change the information and map at one's wish. The limitations of GIS technology due to factors like Modifiable Areal Unit Problem (MAUP). The spatial temporal modelling was explained using leprosy data in an endemic region of Tamil Nadu, South India.

Mr. R. Mahesh Krishnan from Kcube consultancy services demonstrated the importance of Open Source GIS software with special reference to Quantum GIS (QGIS). He also mentioned about the benefits of open source software as it gives the user the freedom, cannot be locked by any vendor, availability of the source code makes the user to alter the programme to one's need, no license cost involved, any number of copies can be made and distributed and the actual cost involved in any Open Source is to do the required Capacity building and Support/Maintenance of the product.

Finally Dr. T.P Ahluwalia shared his research experiences and the studies undertaken by him.

The dignitaries and the participants of the second workshop (13th-15thSep'10) are in the group photograph at the National Institute of Epidemiology.

Views of GIS Users



To understand the nature and requirement of GIS users in and around Chennai, we visited some of the prestigious institutions/organizations that were extensively using GIS technology and their views were personally collected.

Data and Maps

1. In Chennai, Institute of Remote Sensing (IRS), Anna University is designated as the Central Repository for all Geographic Information System applications and digitized maps developed by the Government departments, Statutory Boards and other Undertakings. This planning and development of Data Bank was initiated on 27th March 2001 [http://www.tn.gov.in/gosdb/gorders/pd/pnd-e-30.htm].

   Many of the GIS users are aware of the availability of GIS database on a single platform and Data Bank development at IRS, Anna University. Some users emphasized the need for facilitation of the initiated program and easy access to these maps and data.

   The users felt that availability of various layers (including the updated maps) and data available at Anna University could be made aware to the users through the web.

2. Micro level studies are being undertaken by different institutions/ research organizations, and students for their project work/ dissertation

work, internship work. Also some of the studies are funded by local and international agencies. It should be made mandatory that they should register their work regarding GIS (like Clinical trial registry of India). This will be useful for future approval of funding (to avoid duplication of work) and publication of the papers at state/national level. Further, online registration should be made free of cost. This online registration may contain the details of study area, map to be digitized, objectives etc of the GIS work and may be allotted with a unique identity number for further reference. This will avoid reinvestigation / duplication of micro level maps digitized by various people or agencies thus saving manpower and money.

3. Summarized data is not GIS data. Only summarized GIS data is widely available and open accessible but for GIS users it won't be of much help unless data is in the raw form, preferably at micro level.
4. In many of the instances individual's data is aggregated to district level or state level (to mask and maintain confidentiality) and hence actual variation has been nullified or hidden. For best use, GIS related data has to be stored "as it is condition".
5. Sensitive data can be masked (by shifting the origin of location) and can also be made available at micro level.
6. Sometimes data on individual health required for analyses are scattered across many sources as often it was collected by different agencies. A researcher has to spend major time and money running here and there to fulfill the formalities to acquire the required data.
7. The map scale should be mentioned explicitly in all maps for easy amendments and for error reduction.
8. The quality of health data should be improved and made transparent so that science behind the map is not lost.
9. Proper care should be exercised since many of the technical aspects are overlooked in the process of producing pretty maps.
10. Maps must be designed to communicate effectively and ensured that it suits even a person unaware of the technology.

11. Access to digital maps up to village level should be made easy.
12. Lack of availability of desired standard base maps at appropriate scales is a problem.

Documentation procedures

13. Standard procedures for documented geodata collection and automation of micro level data should be emphasized at all levels.
14. The unique identification code should start right from the state level to the smallest region like - village/town [e.g like PLCN (permanent location code number) for village and towns used in census 2001] for identification, so that any attribute data related to the region may be easily amalgamated and analyzed without much difficulty.
15. Further if alphabets are used in the identification code it should be made case sensitive and moreover unique spelling should be adopted so that the search for the village/town is made easy for identification including with "Google earth".
16. A name change should be uniformly adopted at all levels of data storage. Similarity in the names of villages/towns/streets across different districts/states can be clearly brought out and avoided in future. Currently any person unfamiliar with a region (researchers) finds it difficult to locate or trace the place on a map.
17. Exhaustive documentation on GIS data must be available in each of GIS cell/ Lab., so that frequent change of staff members (of varying interest) and higher authorities do not affect the end users.
18. Recording systems for health and population data are often only rudimentary and hence uniform automation of geo database at all levels and different health sectors should be made mandatory.

Resources

19. All GIS Cells/ Labs should be equipped with adequately trained staff.
20. Cultivation of interest of GIS technology among younger generation should be developed. This would generate a good man power and creation of geodatabase which indeed will be useful in long run.

21. Complete understanding of the spatial statistics is the need of the hour to the GIS users.
22. All GIS users should cultivate a sound knowledge of the theory and calculations behind the software analytical modules. Otherwise it's not only just garbage-in-garbage-out but also misleads the audience (a lay person).
23. Shortage of trained manpower in using Geostatistical modeling needs strengthening.
24. Public health workers must be trained well in the technology for effective outcome of their work.

Future GIS

25. Sharing practices among all GIS users should be encouraged and motivated within the legal framework.
26. In long run all data, related to census, demographic, health, meteorological, hydrological, environmental, geographical, etc should be brought under one Umbrella of “Geo Data Bank” for easy and legal accessibility. This will have better control over utility.
27. Change of policy on the use of existing old methods is a need of the hour. We have to move with the advancement of methods and technology.
28. Large scale surveys like Census, Demographic Surveys, National Family Health Surveys etc. are done at huge intervals of time and do not cover the GIS researchers study period, hence using approximate or projected figures adds error to the result. Hence the large-scale surveys may be planned periodically.
29. Weather data (rainfall and temperature) is not usually available at the scale needed for analysis. Hence more number of weather stations must be introduced in each district.
30. The results presented/ published using complex spatial analytic techniques should be made no longer limited to scientist but also be made simple and comprehensible for public, policy makers, health planners etc.

31. In some tedious and expensive studies using GIS, it was observed that the publication of the results would create a negative impact on the policy decisions and hence kept back or suppressed. It not only leads to wastage of resources but also paves a way to more and more wasteful studies. So the GIS experts felt that as in clinical trial research studies, it was a good practice to publish the trials with null or negative results (i.e. not statistically significant or statistically significant), such practice should be adopted here also.
32. Standard GIS ethics are essential and should be propagated to the users.
33. GIS /Spatial analyst network team needs to be developed.
34. Formalities for the purchase and acquiring of Satellite Imagery like CARTOSAT consumes major study period of the researchers hence stipulated time period can be fixed openly.
35. Data collected inadequately and without proper sampling procedures depict the results for the entire country and often misled.

    Even if there are non-endemic pockets in the endemic districts, the whole district is declared as ‘endemic’ and often misinformed.

    Hence such maps should not be encouraged. Maps of health data should not be misinforming.
36. Statistical maps need to be developed with the help of the statisticians and cartographers with sound knowledge of the GIS technology.
37. All future GIS softwares may be developed with the spatial analytic tools and model building.
38. Maintenance and up gradation (add on modules) of standard softwares should be made cost effective.
39. The purpose of Open source GIS will be lost if it is not user friendly and Self-learning modules are not readily available with the software.
40. Expensive Geodatabase created should be utilized in full, if not at least brought to the public domain for better utility.

Feed back & Suggestions of the workshops

A sample feed back form is attached in Annexure12

- The organizational structure, a variety of lectures from diverse fields and hospitality were excellent.
- The presentations were like an eye opener to the toddlers.
- The workshop should not be a one-time activity.
- The initiatives should be sustained by periodical interactions.
- It is the right time to cultivate the interest by more GIS activities rather than it is too late.
- Lecture on Maps and Cartography could have been made as first lecture.
- Practical demonstration of a case study would be more effective.
- A section on hands on experience using open source software like QGIS needed
- A peer reviewed journal paper related the GIS technology needs discussion with promises and pitfalls
- A Spatial Statistics workshop with the practical application is the immediate need.
- There is a need for net working of GIS analyst for advancement in the technology.
- A sample of “GIS and Public Health” Journal copy may be distributed.

- Easy to use softwares mentioned by them in hierarchy were ArcGIS, MapInfo, EpiMap, GeoDa, KOSMO and QGIS.

Annexure1

ABSTRACTS

Public Health Information System

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Public health management needs information on various aspects like the prevalence of diseases, available health infrastructure through government and private sector, socio – economic data of the villages and the agencies working in any given area along with their spatial distribution and area of influence. The data related to Public Health covering a particular region generally is voluminous, it often becomes difficult to understand and organize the real content. In order to analysis the voluminous data GIS is used for input, storage, retrieval & analysis of complex data and display of data for depicting diseases, incidence & prevalence, planning, monitoring and evaluation of health and related data. The output is on the map of the place under study.

Using the above information System a case study was carried out for Attur, Omalur, Veerapandi and Konganapuram block of Salem district for the morbidity analysis. The various data such as health Infrastructure, Rural morbidity, Urban morbidity, Total morbidity, morbidity by gender, morbidity by Adult, morbidity by child, water quality etc, have been collected and analyzed. The location of water and Air polluting industries were mapped and the existence of fungal infection of skin in those areas were studied and analyzed and the relationships between them were identified.

Geo-spatial modelling of Infectious disease and risk zoning using Remote sensing, GIS and GPS with few case studies

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Malaria, Cholera and Visceral Leishmaniasis are some of the common diseases causing frequent outbreaks under favourable bio-climatic condition and geographic set up especially in the eastern state of West Bengal, India. Cholera is a bacterial disease associated with epochs of excessive rainfall coupled with warm and humid temperature and increase in the phytoplankton population. In the recent past (August, 1998), Maldah district of West Bengal witnessed an

unprecedented diarrhoeal case of 16590 out of which 276 deaths were reported. Diarrhoeal cases were also reported during the flooding of September 2000, July 2002, October 2005 and July 2006 in the region. About 3000 cases were reported from East and West Midnapur districts of West Bengal during the recent flooding of June 2008. Flooding, population migration, sanitation, safe drinking water and geo-environmental parameters are considered for aggravating the risk of diarrhoea. The risk can be minimized if the episode of bacterial transmission cycle is studied vis-à-vis different bio-geo-environmental factors. A study on macro and micro scale information are needed for better understanding and modelling of disease outbreaks. A Systematic study of geo-environmental parameters derived from satellite data in conjunction with ground intelligence enabled modelling of risk zones and temporal suitability towards developing advance warning system. GPS, Geographic Information System technologies integrated with remote sensing have been used for modelling disease epicentres and various risk zones in spatial domain.

High-resolution Indian satellites data from IRS LISS IV (multi-spectral) and Cartosat-2 (pan) have been used for studying environmentally risk parameters viz. peri-domestic vegetation, dwelling condition, wetland ecosystem, land use etc towards risk assessment. Land and Sea surface temperature from MODIS and Chlorophyll from OCM have studied in macro scale and detailed geo-environmental parameters have been studied using IRS LISS IV and Cartosat. Apart from satellite data historical weather data for ground stations and disease information from historical records and ground intelligence were used for model simulation and validation. The disease outbreak has been studied both at macro level in relation to prevailing regional climate and land / surface phenomena as well as micro level where detailed information on wetland, ponds and its use, settlements, source of drinking water supply, sanitation, vegetation conditions, cropping pattern, rainfall, extent and duration of flood inundation, drainage condition and tidal phenomena have been used. The diarrhoeal disease model found to be significantly matching with real situation for the southern part of West Bengal. The results envisages that this bio-geo-climatic model can help predicting proneness of diarrhoeal disease outbreaks and to develop a early warning system for impact minimization.

Uses of GIS in Public Health

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Any organization, government or private organization is in some way or another strongly linked to the geography in which it operates. A GIS that has been designed in a proper manner has the capability of providing quick and easy access to large volumes of data of these geographical features. The user can access & select information by area or by theme to merge one data set

with another, to analyze spatial characteristics of data, to search for particular features, to update quickly and cheaply and asses alternatives.

In simpler terms, GIS allows the user to understand geographic information in an easy manner without having to go through large volumes of data that is in tabular form.

The potential and substantial benefits of using GIS make it a very important tool making the work of any organization easier and more productive. Some of the potential benefits of GIS are:

- Opportunity to reduce sets of manual maps held and associated storage costs.
- Faster and more extensive access to geographic information. Improved analysis e.g. of areas, distances, patterns, etc.
- Better communication of information to public.
- Improved quality of services.
- Better targeting and coordination of services.
- Improved productivity in providing public information.
- Improved efficiency in updating maps.
- The ability to track and monitor growth and development over time.
- Improved ability to aggregate data for specific sub areas.

Thus GIS's have become indispensable tools not only for governance, commerce, environmental and social science but also to Public Health.

Maps & Cartography

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Cartography has been described as “the meeting place of Science and Art.” The primary purpose of a map is to convey information and to illustrate a geographical concept or relationship.

Map has a variety of roles. They are used as aids in thinking visually, spatially and for communication analyses. One of the fundamental cartographic design principles is that the map designer must a clear understanding of the major communication goal of the map.

In view of the benefits of researchers the following points will be discussed

What is map - Earth’s shape - Geoids - Reference Systems- How to define a point on the surface of earth - Scale of map - Classification of maps - What is map Projection and why it is required - map details - Symbology – Contour - Map-making process and development - Modern trend in map making.

A GIS Based Sampling Approach

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This paper presents a Geographical Information System (GIS) based sampling methodology for the survey on Health and Air Quality adapted in Delhi. The stratification used five factors-air quality, distance from the main highway, thermal plants, industrial sites and city centers. The sample of households was selected using a newly developed location based sampling technique. Random points were navigated with the help of Global Positioning System (GPS) to acquire the households. The satellite based indirect measures were used for air quality modeling. The sampling methodology will be illustrated using the preliminary data collected in a survey.

Census and GIS in Tamil Nadu: Macro to Micro Geo-database management system

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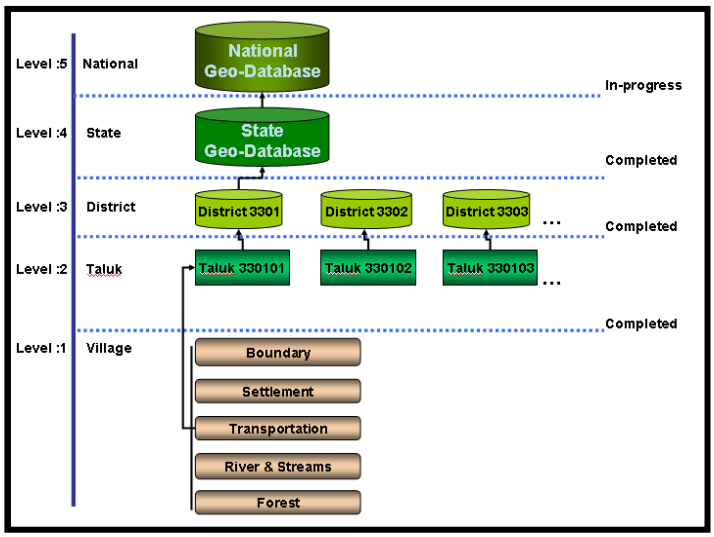
The Census of India has initiated national level spatial data creation of map contents at village/town level in 1997 by using the ArcInfo 3.5 software. By adopting unique identification code called **Permanent Location Code Numbers** for each of administrative units during 2001 census, every spatial entity has been assigned with unique ids to enable attribute linking in future. The creation of digital database has been de-centralised by assigning data conversion work to each of the state directorates. In Tamil Nadu, 30 districts consisting of 201 taluks, covering 16317 villages and 832 towns has been digitized. The database has been designed for enabling the spatial contents to be merged later on to create a State geo-database and further to National geo-database having village / town level layers. A schematic diagram below details the entire data conversion work done at this



directorate.
When integrating different source of spatial content there is always challenges to be met with. This includes, original scale and standard of medium used for mapping, errors added during data conversion, tolerances used for editing. Besides, the software generalization process, which will by default spatially limit the vertices of entities and locations, depends on its resolution capability. We need to look into all these aspects to ensure the quality of database at the initial level of conversion by focusing on the end user products and utilities in mind.
The Census Organization has developed a simplified software package called Census Info for integrating the spatial data and attributes. This is when integrating different source of spatial content there is always challenges to be met with. This includes, original scale and standard of medium used for mapping, errors added during data conversion, tolerances used for editing. Besides, the software generalization process, which will by default spatially limit the vertices of entities and locations, depends on its resolution capability. We need to look into all these aspects to ensure the quality of database at the initial level of conversion by focusing on the end user products and utilities in mind.

The Census Organisation has developed a simplified software package a database system that helps to organize and present data on social development indicators by incorporating the spatial data. The system provides access to indicators organized by broad themes of Socio-Demographic indicators at state / district / sub-district levels based on Census Data generated during 2001. This application integrated with Microsoft Office for easy presentation of data in tables, graphs and maps, which has facility for updating data. Census of India has also implementing macro level GIS for creating census enumeration blocks by using spatial database of buildings initially for all the capital cities of India.

Risk mapping of Lymphatic Filariasis in India

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Information on the spatial dimension of the risk of filariasis for many tropical countries including India was not available, till a short time ago; and hence attempted a geo-environmental risk model (GERM) for predicting the areas of filariasis risk.

The model used various environmental variables that are directly or indirectly influencing the transmission of lymphatic filariasis transmission. The environmental variables include both geo-spatial (Altitude, and Soil Texture) and temporal (Temperature, Rainfall, and Relative Humidity) details. For this purpose data obtained from Shuttle Radar Topography Mission (SRTM), Survey of India (SOI), and Indian Meteorological Department (IMD) were analyzed and customized on GIS platform. Further, the variables were used to determine filariasis transmission risk index (FTRI) for a particular location in a geographical

area using a formula created for model development. In this process, each of these geo-environmental variables has been given appropriate scores for their association with filariasis transmission. Then, the FTRI for a region was calculated by summing up the scores of these variables for that particular region. The values of FTRI have been used to predict the risk and non-risk areas for filariasis. And using this model transmission risk map has been produced for the entire country.

It was validated through a 'ground truth study' following standard procedure, using GIS tools for sampling and Immuno-chromotographic Test (ICT) kits for screening the individuals.

The geo-environmental risk model developed on GIS platform is useful for spatial delimitation purpose on a macro scale, particularly for 'non-risk' areas. Significantly, about 90 districts, which were not surveyed even once under the national program, were found to be with varying degree of risk. This will facilitate the NVBDCP to take an appropriate decision for the ongoing LF Elimination Programme.

Participatory approach to GIS mapping in Public Health

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Advances in other fields of science can offer solutions to many of the age-old problems in Public Health. However before adopting technology into public health we should ensure that the stakeholders are comfortable with it. SCTIMST has done such an initiative wherein doctors, health staff, panchayat members and village women are taken into confidence in adopting geo-spatial mapping of the rural households in its field practice area. All the stakeholders, starting from geologists, informatics specialists, and medical professionals, authorities of local self governments, community leaders, and grass-root level organizations to individual women volunteers were engaged from the very planning stage to the implementation and monitoring stages of the program. The data collection and computerization were done by village women who were trained in the use of computers and GPS handheld. In the end we could perceive a sort of domestication of GIS technology in the area. Health workers own-up the data as they were engaged in the field level supervision of the initiative; Panchayat authorities are eager to explore new possibilities of linking the thematic graphs for local level planning and community action; academics intend to use the initiative to explore disease modelling and pilot test a community based early

warning and response system to contain epidemics of infectious diseases. Gaining strengths from this process SCTIMST endorses the exploration, development and dissemination of people friendly public health technologies as one of its institutional priorities.

Disease surveillance and GIS.

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Access to primary health care is a major factor contributing to the poor health of rural population. Environmental degradation due to extreme weather patterns adds fuel to the faster transmission of contagious diseases posing a serious challenge to public health mangers. Advanced knowledge on the principles underlying the disease transmission dynamics, prediction of occurrence of diseases is possible based on environmental factors and satellite-based remote sensing data. GIS is a technology that could be used to its full potential, especially in the health domain where it is extremely promising. It serves as a common platform for convergence of multi-disease surveillance activities; this article explains how it eventually facilitates utilization of resources, identification and occurrence of diseases, preparedness for preventing disease and promoting health care, working towards the overall rural development.

Can GIS save lives?

S.Raghavendran
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Medical geography aka health geography is an area of medical research that incorporates geographic techniques into the study of health around the world and the spread of diseases. It also includes studies on the impact of climate and location on an individual's health as well as the distribution of health services. Medical geography is an important field because it aims to provide an understanding of health problems and improve the health of people worldwide based on the various geographic factors influencing them. Health geography is

the application of geographical information, perspectives, and methods to the study of health, disease, and health care (Wikipedia)

During the times of the Greek doctor Hippocrates (5th-4th centuries BCE), people have studied the effect of location on one's health. For example, early medicine studied the differences in diseases experienced by people living at high versus low elevation. It was easily understood that those at living low elevations near waterways would be more prone to malaria than those at higher elevations or in drier, less humid areas (geography.about.com). Though the reasons for these variations were not fully understood at the time, the study of this spatial distribution of disease for sure was the beginning of medical geography. It was not until middle of 18th century when the cholera epidemic gripped London that medical geography gained significance.

During the last three decades, a powerful technology has quietly changed the way people view and lives in their neighborhoods, towns, and cities. Most people remain unaware of GIS and its impact-an impact that is as far-ranging as it is useful-despite GIS having grown immensely in the last 15 years, despite hundreds of thousands of people now using the technology, and despite it affecting the daily lives of millions (ESRI).

Be it the pandemic killer swine flu or AIDS of the 20th century, the super power of GIS is its ability to add a spatial perspective to any data being analysed. This has always proved to be very useful to epidemiologists across the globe in elucidating patterns and relationships between the person, place, and time components of epidemiologist data. In addition, GIS technology has been an important tool for understanding and displaying disease or disease risk that are related directly to environmental exposure.

Today, medical geography has a number of applications as well. Since the spatial distribution of disease is still a large matter of importance, with GIS based maps playing a significant role in this field. Google Maps in the recent years has revolutionized the way in which information on several epidemics/ pandemics like swine flu, flu (Google Flu Trends) is delivered to general public.

The Center for Disease Control and Prevention (CDC) in the United States for instance uses what they call the Atlas of United States Mortality to look at a wide range of health factors across the U.S. Data ranges from the spatial distribution of people at different ages to places with the best and worst air quality. The World Health Organization (WHO) features health data for the world with its Global Health Atlas. In India NATMO (National Atlas and Thematic Mapping Organisation) prepares Health and Diseases Atlas for India besides other organisations.

The objective of this paper is to focus on the following two aspects:

- GIS Applications in Medical Geography – Tools & Technologies
- Spatial Epidemiology: Current Trends and Future Challenges

Though GIS has been playing a significant role in the field of medical geography, there are quite a few stumbling blocks/ limitations as well. They could be anything from accurately tracking the first incidence of a disease, the accuracy of data collected to confidentiality laws that can complicate the reporting of a disease.

A final thought: For a moment let us close our eyes and imagine the plight of our human race threatened with a plethora of heath related issues in this 21st century. Of what use could be any technology if it cannot reach and benefit the common public suffering in the veritable concrete jungles, the so-called cities and the remote villages of India? It is a pity that technologies such as GIS and many such applications do not see the light of the day, for one reason or the other. Let us explore ways to apply GIS to make our lives better!

Now, Can GIS save lives? The answer is: on the lighter vein, GIS has been my breadwinner for several years now. GIS may not be the paragon of all virtues but it could be important as one of several measures for addressing the problems confronting the epidemiologist and the medical community in saving the human race, if applied in the right manner, at the right time.

GIS mapping using HIV sentinel surveillance

Mr. A Elangovan, Scientist E,
National Institute of Epidemiology, Chennai 77

Sentinel surveillance was expected to provide information on entry of HIV into the country at various points over a period of time. Since there is no reliable information available for HIV estimates, data available through sentinel surveillance is being used to estimate the HIV load at the national level from year to year by making several assumptions. There are 68 sentinel surveillance centres in Tamil Nadu. Blood samples (around 27,000) have been collected from these centres and tested for HIV positivity. These HIV prevalence rate were plotted in the GIS map and tried to study the pattern of HIV distribution among various districts of Tamil Nadu and to see any pattern is emerging with the national highways. The analysis shows that prevalence values are higher for the centers closer to the National Highways. Generally places on the East Coast of Tamil Nadu have very low prevalence values for HIV. The observed pattern of relationship with the national highways suggests that the epidemic is mainly restricted and follows the pattern of national highways.

GIS and Public Health

Dr. V. Kumaraswami
Scientist F & Director-in-Charge
National Institute of epidemiology
Chennai 77

In order to properly plan, manage and monitor any public health programme, it is vital that up-to-date, relevant information is available to decision-makers at all levels of the public health system. As every disease problem or health event requires a different response and policy decision, information must be available that reflects a realistic assessment of the situation at local, national and global levels. This must be done with best available data and taking into consideration disease transmission dynamics, demographics, availability of and accessibility to existing health and social services as well as other geographic and environmental features.

Geographic information system (GIS) is a computer-aided database management and mapping technology that organizes and stores large amounts of multi-purpose information. GIS adds the dimension of geographic analysis to information technology by providing an interface between the data and a map. This makes it easy to present information to key decision-makers quickly, efficiently and effectively.

Geographic information systems (GIS) provide ideal platforms for the convergence of disease-specific information and their analyses in relation to population settlements, surrounding social and health services and the natural environment. They are highly suitable for analyzing epidemiological data, revealing trends and interrelationships that would be more difficult to discover in tabular format. Moreover GIS allows policy makers to easily visualize problems in relation to existing health and social services and the natural environment and so more effectively target resources.

Applications of GIS in Disaster Management

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Scientist - E
Integrated Coastal and Marine Area Management (ICMAM) project Directorate,
Ministry of Earth Sciences, Govt. of India, Chennai 600 100

GIS based information systems are indispensable in disaster management systems and the use of geospatial tools has become an integrated, well-developed and successful tool in disaster management. Remote sensing and

GIS coupled with numerical models can be a very useful tool to complement conventional methods involved in disaster management and mitigation.

Disaster management programs are developed and implemented through the analysis of information. Most information required for emergency management is spatial in nature and therefore can be mapped. Once life, property, and environmental values are combined with hazards, disaster management personnel can begin to formulate mitigation, preparedness, response, and recovery program needs.

GIS allows emergency management needs to be identified prior to an incident. Disaster events such as tsunami, floods, earthquakes, hurricanes, epidemics, and oil spills, can be modeled and displayed in GIS. Thoughtful application of a GIS can take much of the panic and surprise out of emergencies.

Following the disastrous tsunami in the Indian Ocean on December 26th 2004, the Ministry of Earth Sciences has set up the state-of-the-art early Tsunami warning centre at INCOIS, Hyderabad with all the necessary computing and communication infrastructure to issue alarms/alerts, whenever a pre-set threshold for the occurrence of a tsunami is crossed. The centre provides information about possibility of tsunami generation, its travel time and likely coastal areas to be affected, using inundation maps generated using GIS and numerical modelling. India now boasts of a 24X7 tsunami warning system and the chances of being caught unawares by another deadly tsunami is now a distant possibility.

Open Source GIS for Public Health

Mr. Kumaran Narayanaswamy,

CEO & MD of Kcube Consultancy Services, Chennai 97.

Geographic Information Systems (GIS) plays a vital role in public health sector to research and analyze demographic data along with various health and environmental conditions data. GIS provides a platform for health authorities to evaluate effectiveness, accessibility and quality of various public health services. GIS facilitates and supports data driven policy-making. However cost of GIS tools is seen as the biggest barrier to use this technology for public health research and analysis. Open Source GIS has got matured and user friendly allowing public health department to make research and analyze spatial patterns in health sector. Open-source GIS software provides the opportunity to build information systems at very low cost allowing health departments with modest resources access to modern data analysis and visualization tools. There are various Desktop and Web Mapping GIS tools available, which can be leveraged by Public Health practitioners for public health mapping. In the presentation we explain the potential of open source GIS technologies, various tools available and the applications that can be developed for Public Health sector using GIS.

GIS: Practice of good mapping

Dr. Vasna Joshua,
Technical Officer A, NIE, Chennai 77

Maps play a vital role in Geographic Information System. A tremendous amount of information could be portrayed in a map. Too much information may blind the core theme or too little information may lose its audience. A poorly designed map fails to communicate effectively, and may in fact deliver the wrong message to the audience (Monmonier, 1993). A good map must include a common set of design elements. The map designer/researcher needs to give the scale of the map with the scale bar. According to one's needs and usefulness the small scale or large-scale map should be opted. Information about projections and coordinate systems also is one of the most important fields of geospatial metadata. Without this information it is difficult to share data across organizations. Researchers should make use of good graphic communication and careful use of shape, size, value, pattern, hue or colour and direction. A good researcher should select an appropriate type of map and also with the choice of classification method (quantile method, natural Jenk's algorithm etc.) for their application.

The existence of a spatial pattern alone in a data set cannot demonstrate nor prove a casual mechanism. The spatial analyst has a large number of tools for documenting and quantifying associations between the spatial patterns of two or more variables like cross correlograms etc. Similar to the classical correlation techniques, an existence of spatial association does not reveal causality.

Because of the need to protect patient's identity the available data are often aggregated to a sufficient extent and due to Modifiable Areal Unit Problem (MAUP) the aggregated data can dramatically impact analysis and make the test for associations problematic.

Small area problems should be well addresses with the well-established statistical techniques.

Spatial and temporal mismatch in case of the disease like lung cancer wherein the latency period involves a long time span and when examining for possible associations between air toxics and lung cancer a more detailed study is needed before any conclusion. While building predictive models if the data exhibits spatial autocorrelation then this factor needs to be addressed in the model. Otherwise the model will be misleading.

With an increased accessibility to desktop computer systems and geo-referenced health data greater care should be exercised to bring out thoughtful, meaningful and appropriate applications.

GIS Technology Utilization- Prospects and Problems

Prof. T. Natarajan
Former Director of IRS, Anna University,
Currently Chair Professor, Anna University, Chennai- 25

Health and Education sectors are considered the most important for the development of the society. Investment in these sectors yield dividends slowly but in the long run the manpower and infrastructure would give returns exponentially. Perhaps proper utilization of certain modern technologies such as Remote Sensing, GIS, Communication and Information technology may hasten the growth rate.

Remote Sensing Technology provides environmental data with a high Cost-Benefit ratio
GIS Technology provides an efficient Decision Support System for management of the available resources. The Communications and Information Technology. Provides the desired reach to the target Group. In the case of the Health sector. Better utilization of the above three technologies would definitely accelerate the development faster.

Remote Sensing Technology currently provides very high resolutions in the spatial, spectral, radiometric and temporal domains providing Geospatial information of the highest order. Land, water and atmosphere are continuously monitored by satellites with different sensors in the optical, thermal and microwave bands providing the much needed data about our environment. The Health sector needs such reliable data at local and global level.

GIS Technology provides the following capabilities:

- **Spatial** statistical analysis of health related Data
-**Geo Referencing** of health data with GPS
-Data Base Management System integrating the underlying **MAP.**
-Spatial Decision Support System to provide solutions to intricate problems

The communications and Information Technology provides the - Multi media power for delivery of the end results to the target group.

There are problems in the implementation of the above technologies

Lack of standard base maps at proper scales
Lack of standards for data formatting
Sharing of collected data
Security aspects of classified data
Shortage of trained Manpower
Software cost and its maintenance

Lack of compulsion for utilizing the created GIS database.

Dedicated efforts of R and D personnel in the Health sector with assistance derived from GIS, Remote Sensing and ICT specialists are needed along with Policy Support of the Government for better E- governance of the Health Sector

Health GIS – Addressing Conceptual and Structural Aspects

Prof. N. Sivagnanam
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Currently Col. Colonel Mackenzie Chair person, Anna University

Health GIS has to account (mostly) dynamic aspects of environment, diseases and intended population. Health and ill-health are time dependent; Accounting time-dependent or time controlled spatial patterns, which is basic in health GIS, requires understating the structure of time in relation with health / ill-health outbursts. Health outbursts also range from (some) very short and sudden eruptions to long, delayed - phase-by-phase manifestations. Presenting such dynamic structures are quite challenging tasks in GIS

Measurement strategies are to be addressed conceptually; to overcome the failure in direct measurements in health GIS applications. Comprehensive statements on the basis of disease survey information are yet another major interest area in GIS; because the surveys are on static specific in the dynamic systems. Summarizing the risk and vulnerability in regional and community perspectives requires adoption of trade off principles in GIS analysis. Justification of space related resource allocation on the basis of projections or estimations with limited data requires careful analysis plans.

GIS in decision support of vector borne disease control in India.

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Geographic Information System (GIS) have been in to existence for more than 20 years, but the recent development in software has made its use much easier for diverse fields. Geographic Information System, a computer assisted system, facilitate inputting, processing, analyzing, integrating and presenting both spatial and non-spatial information. In India, National Institute of Malaria Research was the first to conduct studies using GIS for decision support in vector borne disease control, a few important projects are mentioned here.

RS and GIS helped in estimating larval production in a lake in Delhi, which showed a good correlation with the adult density in the nearby area. Using GIS

malaria receptivity of Nadiad Taluka, district Khaeda, Gujarat was mapped, the ground verification resulted in complete reconciliation of cause and effect relationship in explaining malaria epidemiology in the region. An attempt was made to create an information management system based on Geographic Information System (GIS) for efficient planning, implementation and evaluation of urban malaria control in Dindigul, Tamil Nadu. A click of the mouse on the respective geographic unit instantly retrieves the information attached. The areas can be zoomed into micro level over view. A GIS based technique has been evolved to map Indian anophelines including malaria vectors. The technique development to map distribution of Indian Anophelines can be used to delineate the areas favorable for any species of flora and fauna, which is very useful for precision surveys. For any disease, once the vector distribution is known, control activities could be limited to the favourable areas for cost effective control of disease.

The GIS offers new and expanding opportunities to look into disease epidemiology because it allows to choose between options when geographic distributions are part of the problem.

Historic Disaster Database Creation and Disaster Impact Analysis - A case study Tamil Nadu State

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Disasters by definition involve widespread physical damages and /or loss of life. Establishing the extent of damage, morbidity and mortality is fundamental for relief, recovery and reconstruction planning. Disasters can have serious impact on social life in general and in particular on economy. One of the factors that plays a very important role in preparing effective counter measures against future natural disasters is the information on previous disasters, including what measures were taken against and what scale of natural disasters, how effective or ineffective they were and what were the lessons learned from the experiences. Compiling a database of natural disasters that have occurred in this century in Asia will be a valuable asset in the next century (ADRC, 2006). Information becomes useful only when referred to for analysis. Analysis of collected information is beginning to help clarify the specific circumstances and need of various people.

The State of Tamil Nadu was the most affected in terms of human tragedy, property loss in the Indian Ocean Tsunami on 26th December 2004. Also, the state faces severe crisis every year because of seasonal floods. The creations of

historic database becomes necessary to know about trends, patterns and seasonality of disasters affecting the state and have a holistic approach towards long term preparedness and mitigation of Disasters. The DesInventar (herein used as IndisData) methodology is a cost effective system used in Latin American countries to systematically record time, place, and effects of disasters on their occurrence. The methodology uses Indisdata software, a web based simple tool to capture the data and analyze it to create charts, tables, graphs for decision making. A Memorandum of Understanding (MoU) was signed between United Nation Development Program (UNDP) and CDMM, VIT University to validate and analyze the database. Disaster data for the period 1975-2007 was collected from the authentic government agencies. The collected data in the prescribed format was compiled and properly scrutinized before data entry. There are several qualifications and limitations in the Historical Disaster Information System and the preliminary analysis that have to be taken into consideration. The availability of good records from 1976-2006 is considered for the present analysis. The multi-hazard affected districts and of the Tamil Nadu state classified based on the impact score. The districts impact score ranked based on all hazard impact and specific hazard impact. The final out put in the form of an online database, which can be used by any public and the stakeholders.

Key Words - Hazard, disaster, impact and database

Acknowledgements

I gratefully acknowledge the facilities provided by Dr.G. Viswanathan, Chancellor, VIT University, Vellore, India. Mr. Rajesh Sharma, UNDP, Bangkok, and Mr. Muhammad Akram, Formerly in UNDP, India are gratefully acknowledged for the database. The United Nation Development Programme (UNDP), India is acknowledged for the financial support under DRM Project. I thank Prof. S.K. Sekar, Director, Centre for Disaster Mitigation and Management, VIT University, Vellore for his constant encouragement.

SANITARY INVENTORY & GIS

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Survival without safe drinking water or sanitation remains a struggle and death from preventable disease is common for millions of the world children. The health and hygiene program seen to have not only helped to improve the overall hygiene and sanitation standards of children inside and outside school but also helped indirectly to increase attendance of girl students in schools. This paper appraises the potential use of GIS as an effective tool to manage and monitor SSHE related activities in primary schools of Tamilnadu where in the focus is the

children and the facility provided to them in schools. If a click of a mouse could open up an entire range of data on school in remote area of Tamilnadu, planning would become better and program could be initiated to take necessary action for the provision of lacking sanitation and Hygiene education facility to save the school going children from diarrhea, skin and eye infection. UNICEF has been able to accomplish this in Tamilnadu through the use of Geographical information system. Started in Erode district, the results prompted to expand the program for all the districts of Tamilnadu. It has ensured an efficient distribution of funds to schools that need toilets and drinking water facilities under the Total sanitation campaign based on data collected systematically from the states 30000 primary schools. This has helped to map details of water, sanitation and hygiene education facility in all of the states schools. The attributes throw light on the enumeration of school goers, the facilities available and users with breakup. District officials inspired to see the details on spatial format starts the action plan there itself in prioritizing the block, school and the program component. The periodical updating of data indicate considerable shrinkage of non-availability of SSHE facilities as well as more number of schools brought under SSHE components. The plan has been shared at the national level as a model for all districts targeted by the total sanitation campaign.

GIS based Donor Information System

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Phone calls to friends and relatives with a great deal of anxiety are quite common during medical emergencies arising out of accidents or illness or other such medical conditions. Any help from unknown quarters comes as a big relief. But one is often caught scrambling during such critical times for much-needed information, the information regarding donors.

It is needless to emphasize the plight of those looking out for blood donors especially of rare blood groups during such medical emergencies. If such is the situation with information on blood donors, imagine the nightmare of those looking for information on donors of other types such as bone marrow, kidney, liver, lungs, eyes etc not getting the required information at the appropriate time. Everyday thousands of lives are lost for want of such critical information at the appropriate time. When lives are at stake, every second counts and words

cannot describe the plight of the near and dear ones, running from pillar to post in locating the donors.

Geography or GIS for that matter has never been so closer offering a helping hand in our day-today life. Web based and even GIS based blood bank/ blood donor information systems are already the order of the day. But for some reason the concept has not extended beyond blood banks and blood donors into other types of medical donors like eye, kidney, bone marrow, lung, liver donors etc. and corresponding donor banks/ facility.

The objective of this paper is to focus on the following aspects:

- To create awareness on the need to integrate GIS into the daily lives of the hoi polloi at various levels.
- To show how GIS can effectively be used in a myriad of ways to not only locate blood banks and blood donors quickly at the critical hour, thereby saving valuable human lives but to take it a step beyond to other types of donors.
- To discuss how using ICT, the entire process could be automated to automatically update and respond based on the database of donors versus recipients who have registered in the system by way of server based GIS and mobile/sms technology.

"Brain death" something hitting the headlines these days refers to the irreversible end of all brain activity (including involuntary activity necessary to sustain life) due to total necrosis of the cerebral neurons following loss of blood flow and oxygenation. Brain stem death (not whole brain death) is taken to be the significant indicator of death. Brain death may result in legal death, but still with the heart beating, and with mechanical ventilation all other vital organs may be kept completely alive and functional, providing optimal opportunities for organ transplantation. Most organ donation for organ transplantation is done in the setting of brain death. In some nations (for instance, Belgium, Poland, Portugal and France) everyone is automatically an organ donor, although some jurisdictions (such as Singapore, France, or New Zealand) allow opting out of the system. Elsewhere, consent from family members or next-of-kin is required for organ donation. (Source: http://en.wikipedia.org/wiki/Brain_death).

With the success of organ transplantation as an effective modality of treating end stage disease of various organs, increasing numbers of organ transplants are being performed all over the world. However, this procedure requires a "donor" pool of either "living" or "cadaveric" donors. Since this pool is limited, the gap between "demand" and supply is widening, which is further hampered with the non-availability of information regarding this limited donor pool at the right time. In the context of organ donation "cadaveric" donation has largely meant "brain dead" or "heart beating" donors. Such cadaver organ donation no doubt requires

a robust IT/GIS based operational support system as its backbone to effectively utilize such cadaver donors.

A final thought: For a moment let us close our eyes and imagine the plight of the near and dear ones scrambling for information on donors, during medical emergencies. How thoughtful it would be if a donor registered for eye donation breathes his last and a SMS with the donor ID to a centralized server with details regarding the place, date and time of death etc. This SMS then triggers of a set of GIS analysis on the server based on parameters such as the list of recipients registered in the vicinity of the donor considering medical factors for organ donation along with the spatial separation between the donor, recipient and the transplantation facility. The end result is an alert to either to the recipient/ care taker/ medical facility with location details of the donor.

A new concept such as this GIS based donor information system definitely needs inputs and support from all quarters and needs to be experimented, given a deep thought to put in practice.

The donors may be living or cadaver, their hearts beating or not beating, but let our hearts beat as one for a GIS based Donor Information System!

Linked Micromap Plots and Conditioned Choropleth maps with application to Public Health data

Dr. Vasna Joshua

Technical Officer A, NIE, Chennai 77.

A wide variety of maps have been used to display health related data. Carr et al (2000) has developed templates for displaying geospatially-indexed estimates: linked micromap (LM) plots and conditioned choropleth (CC) maps.
Linked Micromaps (LM) provide a template in which multivariate estimates are associated with each spatially indexed study unit. The primary purpose of LM plots is the communication of geospatially indexed statistical summaries.
Conditioned Choropleth Maps (CC) provide a template that shows the connection between a dependent variable (as represented in a classed choropleth map) and two explanatory variables. The purpose of CC maps is to help researchers generate sharper hypotheses about observed spatial patterns.
The above-mentioned innovative approach will be explained using Infant Mortality rates (IMR) of India.

Need for GIS in Public Health

Mr. A. Elangovan
Scientist E, NIE, Chennai 77.

Effective systems for monitoring progress and outcomes are very important in all programme implementation of Public Health. Today, Health and ill-health are being affected by a variety of life-style and environmental factors like climate, water, land use etc. GIS permits the users to easily link their own public health indicators and present information in simple visual formats. GIS can help in understanding of the distribution of disease and its relationship with these environmental factors. It also used to analyze the trend and inter-relationship of variables that are more difficult to discover in a traditional methods. Therefore, GIS be seen as a valuable management and monitoring tool in Public Health.

Annexure2

List of Institutions/Organization/colleges/ government institutions where in GIS used /users were identified.

- Regional census Office, III Floor Rajaji Bhawan, Besant Nagar, Chennai.
- National Informatic Centre (NIC), I Floor Rajaji Bhawan, Besant Nagar, Chennai.
- University of Madras, Department of Geography, Chepauk, Chennai - 600005.
- Indian Institute of Technology Madras, Environmental & Water Resources Engineering Division, Chennai 600036
- Regional meteorological Centre, College road, Chennai-600006
- Loyola College, Unit of Environmental Health and Biotechnology, Chennai-600034.
- Tamilnadu Water Supply and Drainage Board, Kamarajar Salai, Chennai-600005.
- National Institute of Malaria Research Centre, Chennai-600077.
- Corporation of Chennai, Geomatics Division, Ripon building, Chennai-600003.
- Directorate of Public Health and Preventive Medicine, 359 Teynampet, Chennai 600 006.
- National Rural Health Mission, Chennai- 600006.
- Survey of India, Block III, Electronics Complex, Thiru-vi-ka Industrial Estate,Guindy, Chennai 600032.
- Christian Medical College, Dept of Bio-statistics, Vellore
- Institute of Remote Sensing, Anna University, chennai-600025.
- Centre of water resources, Anna University, Chennai-600025.
- Ocean Engineering, Anna University, Chennai-600025.

- Centre for climate Change & Adaptation Research, Anna University, Chennai-600025

- MS Swaminathan Research Foundation, 3rd cross road, Tharamani, Chennai 600 013.

- Vellore Institute of Technology (VIT), Environmental, Water Resources & Transport Engg. Division, Vellore 632014.

- Vellore Institute of Technology (VIT), Centre for Disaster Mitigation & Management, Vellore 632014.

- CHAD (Community Health and Development), CMC, Vellore

- SRM University, Civil engineering dept, Kattankulathur, Kancheepuram district.

- The Centre for Research in Medical Entomology, Chennai 77.

- NIOT, Govt. of India, Ministry of Earth Sciences,
  ICMAM Project Directorate, III rd Floor, Pallikaranai,
  Chennai 600100.

- JIPMER (Jawaharlal Institute of Medical Education Research),
  Institution of National Importance Dhanvantri Nagar,
  Puducherry 605006, India.

- Vector Control research Centre (VCRC)
  Medical Complex, Indira Nagar,
  Puducherry – 605006.

Annexure3

Advertisement

ICMR (HSRC) sponsored workshop for GIS users

"Geographic Information System (GIS) and Public Health: Practice of a good mapping" – 6-8th September 2010 &13-15th September 2010.

National Institute of Epidemiology (NIE), Chennai is organizing two workshops on 6th to 8th September 2010 and 13th to 15th September 2010 at NIE. The workshop is designed to offer comprehensive guidance of those who are using Geographic Information system (GIS) for public health related activity in their work place. The learning objectives are -

1. Quality and promotion of a spatial data set infrastructure at a micro level
2. Propagation of guidelines in producing good quality disease maps with specification of map accuracy.
3. Proper usage of the map analysis and
4. Effective usage of the GIS technology in health research.

Eligibility:

1. GIS users.
2. Health care providers/ public health practitioners / Researchers from Government and non Govt. Organizations / Institutions actively involved in health research.

Application Deadline: July 31, 2010.

Workshop Coordinators: Dr. Vasna Joshua & Mr. A.Elangovan, NIE.

Application forms should be submitted through proper channel or with 'no objection certificate' from the present employee and may be sent by post (marked as "Application for the workshop for GIS users") or thro' email

The Director/ Coordinator
National Institute of Epidemiology,
R127, Third Avenue,
Tamil Nadu Housing Board Colony,
Ayapakkam, Chennai -600 077, India.

E-mail at gisnie2010@gmail.com

Fifteen participants per batch will be selected from various states and the selected participants will be informed within 10 days. ICMR employees should be nominated by their respective Heads of Department and TA & DA claims made at their respective institutes. For other participants, shortest II AC train fair & DA will be given as per ICMR rules.

Limited accommodation facility is available at our hostel. Those who need accommodation should indicate their option in the application form. It will be on first come, first served basis.

Support:

Health System Research Cell (HSRC),

Indian Council of Medical Research,

Dept. of Health Research, Ministry of Health & Family Welfare,

Ansari Nagar,

New Delhi 110-029, India

Contact Details:

The Director / Coordinator

Phone no: 044 - 26136317 / 26136307

Fax no: 26820464 / 26820355

Email: gisnie2010@gmail.com

APPLICATION FORM FOR THE WORKSHOP FOR GIS USERS

"Geographic Information System (GIS) and Public health: Practice of a good mapping"
6-8th September 2010 & 13-15th September 2010

1.	**Name of the applicant: (in Capital)**		
2.	**Age**		**3. Sex** Male/Female
4.	**Educational Qualification**		
5.	**Designation**		
6.	**Name of the Institutes/ Organization (working) with complete address**		
7.	**Area of Research/ Teaching/Working**		
8.	**GIS Software used** **ArcGIS/ MapInfo/ Health Mapper/ ATALS GIS/ Geoda/ GRASS GIS/ EPIMAP/ *SAS GIS/ any other specify***		
9.	**Any published / unpublished work done in GIS to be attached (Word / pdf etc.) (Relevant to Justify)**		
10.	**Date of preference**	**i) 6-8th Sep 2010**	**ii) 13-15th Sep 2010**
11.	**Address for correspondence** **Phone / Mobile No.** **Email:**		
12	**Whether applied thro' proper channel / with no objection certificate**	**Yes /No**	
13	**Accommodation required**	**Yes /No**	
Date: **Place:**		**Signature**	

Annexure4

Workshop I (6th – 8th Sep'10)

S.No	Speakers	Topic	I workshop
1.	Prof. M.Ramalingam, **Director, IRS** Anna University Chennai 25.	Health Information System	6.9.2010
2.	Dr. A. Jeyaram **General Manager & Project Director** Regional Remote Sensing Service Center (East) **(ISRO),** IIT Campus, Kharagpur West Bengal 721302.	Geo-spatial modeling of infectious disease and risk zoning with few case studies	6.9.2010
3.	Dr. M. Jagadeesan **Health Officer** Public Health Department Corporation of Chennai Chennai 3.	Uses of GIS in Public Health.	6.9.2010
4.	Mr. B. K. Roy **Superintending Surveyor** Data Management Wing Survey of India, Chennai 32.	Maps and Cartography	6.9.2010
5.	Dr. P. Venkatesan **Scientist E** Tuberculosis Research Centre (ICMR) Chennai 31.	GIS based sampling methods for Health Surveys	6.9.2010
6.	Dr. R. Joseph / Mr. A. Lazar **Research Officer / Senior Geographer** Directorate of Census Operations, Chennai 90.	Census & GIS in Tamil Nadu: Macro to Micro geo-database management	7.9.2010
7.	Dr. Sabesan **Scientist F** VCRC (ICMR), Pondicherry 605006.	Risk mapping of Lymphatic Filariasis in India	7.9.2010
8.	Dr. Biju Soman, **Assistant Professor** Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology Thiruvananthapuram–695011, Kerala, India.	Participatory approach of GIS mapping for public health	7.9.2010
9.	Mr. M. Devarajan **Manager GIS (Rtd)** TWAD board Chennai 6.	Disease Surveillance & GIS	7.9.2010
10.	Mr. S. Raghavendran **Manager Technical - GIS** PIXEL SOFTEK PVT. LTD. Chennai 6.	Can GIS save lives?	7.9.2010
11.	Mr. A. Elangovan **Scientist E** NIE, Chennai 77.	GIS mapping using HIV sentinel surveillance	7.9.2010

12.	Dr. V. Kumaraswamy **Scientist 'F'& DIC** NIE, Chennai 77.	**GIS & Public Health**	8.9.2010
13.	Dr. Tune Usha **Scientist E** ICMAM, NIOT campus**,** Pallikaranai, chennai 100.	Application of GIS in Disaster Management	8.9.2010
14.	Mr. Kumaran Narayanaswamy **CEO & MD of Kcube Consultancy Services** Chennai 97.	Open Source GIS for Public Health	8.9.2010
15.	Dr. Vasna Joshua, **Technical Officer** A NIE, Chennai 77.	GIS: Practice of good mapping	8.9.2010

Annexure5

Workshop II (13th – 15th Sep'10)

S.No	Speakers	Topic	II workshop
1.	Prof. T. Natarajan **Former Director of IRS** **Currently Chair Professor** Anna University, Chennai 25.	GIS Technology Utilization – Prospects & Problems	13.9.2010
2.	Dr. N. Sivagnanam **Former Head of the Dept. of Geography** Madras University **Currently Col. Colonel Mackenzie Chair person** Anna University, Chennai 5.	Addressing Structural & Conceptual GIS in health	13.9.2010
3.	Dr. B. N. Nagpal, **Scientist E** National Institute of Malaria Research (ICMR) New Delhi 110077.	Use of GIS in decision Support & policy making	13.9.2010
4.	Dr G.P. Ganapathy **Associate Professor** VIT, Vellore 632 014.	Historic Disaster Database & Analysis	13.9.2010
5.	Mr. B. K. Roy **Superintending Surveyor** Survey of India, Chennai 32.	Maps and Cartography	13.9.2010
6.	Dr. P. Venkatesan **Scientist E** Tuberculosis Research Centre Chennai 31.	GIS based sampling methods for Health Surveys	14.9.2010
7.	Dr. R. Joseph **Research Officer** Directorate of Census Operations, Chennai 90.	Census & GIS in Tamil Nadu: Macro to Micro geo-database management	14.9.2010
8.	Mr. M. Devarajan **Manager GIS (Rtd)** TWAD board, Chennai 6.	Sanitary Inventory & GIS	14.9.2010
9.	Mr. S. Raghavendran, **Manager Technical - GIS** PIXEL SOFTEK PVT. LTD. Chennai 6.	GIS based Donor Information System	14.9.2010
10.	Dr. Vasna Joshua **Technical Officer A** National Institute of Epidemiology (ICMR) Chennai 77.	Application of Linked Micromap Plots and Conditioned Choropleth maps to a Public Health data	14.9.2010
11.	Mr. A. Elangovan **Scientist E** National Institute of Epidemiology (ICMR) Chennai 77.	Estimation of HIV infection using GIS	14.9.2010
12.	Dr. V. Kumaraswamy **Scientist 'F' & DIC** NIE (ICMR), Chennai.	GIS & Public Health	15.9.2010

13.	Mr. A. Elangovan, **Scientist E** National Institute of Epidemiology (ICMR) Chennai 77.	Need of GIS in Public Health	15.9.2010
14.	Mr. R. Mahesh Krishnan **KCube Consultancy Services** **Business Development Associate** Chennai 97.	Open Source GIS for Public Health	15.9.2010
15.	Dr. Vasna Joshua **Technical Officer A** National Institute of Epidemiology (ICMR) Chennai 77.	GIS: Practice of good mapping	15.9.2010

Annexure6
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Annexure7

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Annexure8

Workshop I

National Institute of Epidemiology (ICMR)

ICMR (HSRC) sponsored workshop for GIS users

"Geographic Information System (GIS) and Public Health: Practice of a good mapping" 6th-8th September 2010

AGENDA FOR INAUGURAL ON 6th Sep (9:30 am– 10:30am)

Time	Activity	Speaker
9:30 - 9:40 am	Welcome address	Mr. A. Elangovan
9:40 – 9:50 am	Presenting Bouquet/memento to the Dignitaries	
9:50 – 10:00 am	Presidential address	Dr. V. Kumaraswami
10:00 – 10:10 am	Key note address	Prof. M. Ramalingam
10:10 –10:20 am	Special Key note	Dr. A. Jeyaram
10:20 – 10:30 am	Vote of thanks	Dr. Vasna Joshua

Annexure9

Workshop II

National Institute of Epidemiology (ICMR)

ICMR (HSRC) sponsored workshop for GIS users

"Geographic Information System (GIS) and Public Health: Practice of a good mapping" 13th-15th September 2010

AGENDA FOR INAUGURAL ON 13th Sep (9:30am – 10:30am)

Time	Activity	Speaker
9:30 - 9:40 am	Welcome address	Mr. A. Elangovan
9:40 – 9:50 am	Presenting Bouquet/memento to the Dignitaries	
9:50 – 10:00 am	Presidential address	Dr. V. Kumaraswami
10:00 – 10:10 am	Key note address	Prof. T. Natarajan
10:10 –10:20 am	Special Key note	Dr. T.P Ahluwalia
10:20 – 10:30 am	Vote of thanks	Dr. Vasna Joshua

Annexure 10

Workshop I Schedule

DAY 1 – 6.9.2010

Time	Topic	Faculty
09:00-09:30	*Registration*	
09:30-10:30	*Welcome & Inaugural session*	
10:30-11:00	*Tea*	
11:00-12:00	Lecture 1: Public Health Information System	Prof. M.Ramalingam
12:00-13:00	Lecture 2: Geo-spatial modelling of Infectious disease and risk zoning using RS, GPS & GIS few case studies	Dr. A. Jeyaram
13:00-14:00	*Lunch*	
14:00-15:00	Lecture 3: Uses of GIS in public Health	Dr. M. Jagadeesan
15:00-15:30	*Tea*	
15:30-16:30	Lecture 4: Maps & Cartography	Mr. B.K. Roy
16:30-17:30	Lecture 5: GIS based sampling methods for Health Surveys	Dr. P. Venkatesan

DAY 2 – 7.9.2010

Time	Topic	Faculty
09:30-10:30	Lecture 6: Census & GIS in Tamil Nadu: Macro to Micro Geodatabase management	Dr. R. Joseph / Mr. A. Lazar
10:30-11:00	*Tea*	
11:00-12:00	Lecture 7: Risk mapping of Lymphatic Filariasis	Dr .S. Sabesan
12:00-13:00	Lecture 8: Participatory approach of GIS mapping for Public Health	Dr. Biju Soman
13:00-14:00	*Lunch*	
14:00-15:00	Lecture 9: Disease Surveillance & GIS	Mr. M. Devarajan
15:00-15:30	*Tea*	
15:30-16:30	Lecture 10: Can GIS Save Lives?	Mr. S.Raghavendran
16:30-17:30	Lecture 11: Estimation of HIV infection using GIS	Mr. A. Elangovan

DAY 3 – 8.9.2010

Time	Topic	Faculty
09:30-10:30	Lecture 12: GIS & Public Health	Dr. V. Kumaraswami
10:30-11:00	*Tea*	
11:00-12:00	Lecture 13: Application of GIS in Disaster Management	Dr. Tune Usha
12:00-13:00	Lecture 14: Open Source GIS for Public Health	Mr. K. Narayanaswamy
13:00-14:00	*Lunch*	
14:00-15:00	Lecture 15: GIS: Practice of Good mapping	Dr. Vasna Joshua
15:00-15:30	*Tea*	
15:30-17:00	Feedbacks & closing section	

Annexure 11

Workshop II Schedule

DAY 1 13.9.2010

Time	Topic	Faculty
09:00-09:30	*Registration*	
09:30-10:30	*Welcome & Self introduction by participants*	
10:30-11:00	*Tea*	
11:00-12:00	Lecture 1: GIS Technology Utilization- Prospects and Problems	Prof. T. Natarajan
12:00-13:00	Lecture 2: Addressing structural & conceptual health by GIS	Dr. N. Sivagnanam
13:00-14:00	*Lunch*	
14:00-15:00	Lecture 3: Use of GIS in decision support and policy making	Dr B.N. Nagpal
15:00-15:30	*Tea*	
15:30-16:30	Lecture 4: Historic Disaster Database creation & Impact analysis	Dr. G.P.Ganapathy
16:30-17:30	Lecture 5: Maps & Cartography	Mr. B.K.Roy

DAY 2 14.9.2010

Time	Topic	Faculty
09:30-10:30	Lecture 6: GIS based sampling methods for Health Surveys	Dr. P. Venkatesan
10:30-11:00	*Tea*	
11:00-12:00	Lecture 7: Census & GIS in Tamil Nadu: Macro to Micro Geodatabase management	Dr. R.Joseph
12:00-13:00	Lecture 8: Sanitary Inventory & GIS	Mr. M. Devarajan
13:00-14:00	*Lunch*	
14:00-15:00	Lecture 9: GIS based Donor Information System	Mr. S.Raghavendran
15:00-15:30	*Tea*	
15:30-16:30	Lecture 10: LM Plots and CC maps with application to Public Health data	Dr. Vasna Joshua
16:30-17:30	Lecture 11: Estimation of HIV infection using GIS	Mr. A. Elangovan

DAY 3 15.9.2010

Time	Topic	Faculty
09:30-10:30	Lecture 12: GIS & Public Health	Dr. V. Kumaraswami
10:30-11:00	*Tea*	
11:00-12:00	Lecture 13: Need for GIS in Public Health	Mr. A.Elangovan
12:00-13:00	Lecture 14: Open Source GIS for Public Health	Mr. R. Mahesh Krishnan
13:00-14:00	*Lunch*	
14:00-15:00	Lecture 15: GIS: Practice of Good mapping	Dr. Vasna Joshua
15:00-15:30	*Tea*	
15:30-17:00	Feedbacks & closing section:	

Annexure 12
Feedback Form

"GIS &Public Health: Practice of good mapping"- September 2010

WORKSHOP FEED BACK FORM

Please take a moment to complete this **feedback form**. Your comments will assist us in improving our future workshops.

* **This information is kept confidential** *

PARTICIPANT INFORMATION

Name (Optional): Date:

EVALUATION

SCALE: 1- STRONGLY AGREE; 2 – AGREE; 3 – NEUTRAL; 4 –DISAGREE; 5 – STRONGLY DISAGREE

	1	2	3	4	5	Comments
1. The **workshop** organization was good.	☐	☐	☐	☐	☐	
2. The **workshop** was informative.	☐	☐	☐	☐	☐	
3. The **workshop** facilities were satisfactory.	☐	☐	☐	☐	☐	
4. The **workshop** time slot for each presentation was adequate.	☐	☐	☐	☐	☐	
5. The presenter answered to questions was appropriate and in a satisfactory manner.	☐	☐	☐	☐	☐	
6. Guest lectures were good and useful.	☐	☐	☐	☐	☐	
7. Please tell us in one or two lines, what you liked best about the presentation.						
8. Please tell us in one or two lines, what you did not like and that needs improvement about the presentation						
9. Would you recommend this workshop to a colleague/friend?	Yes	☐		No	☐	

10. Can you name one GIS software easy to learn and use.

11. What is your opinion about the open source GIS software?

12. Can you specify (at least three points) the difficulties you faced in the application of GIS technology and its limitations (related to data, software, personnel.....)

a.

b.

c.