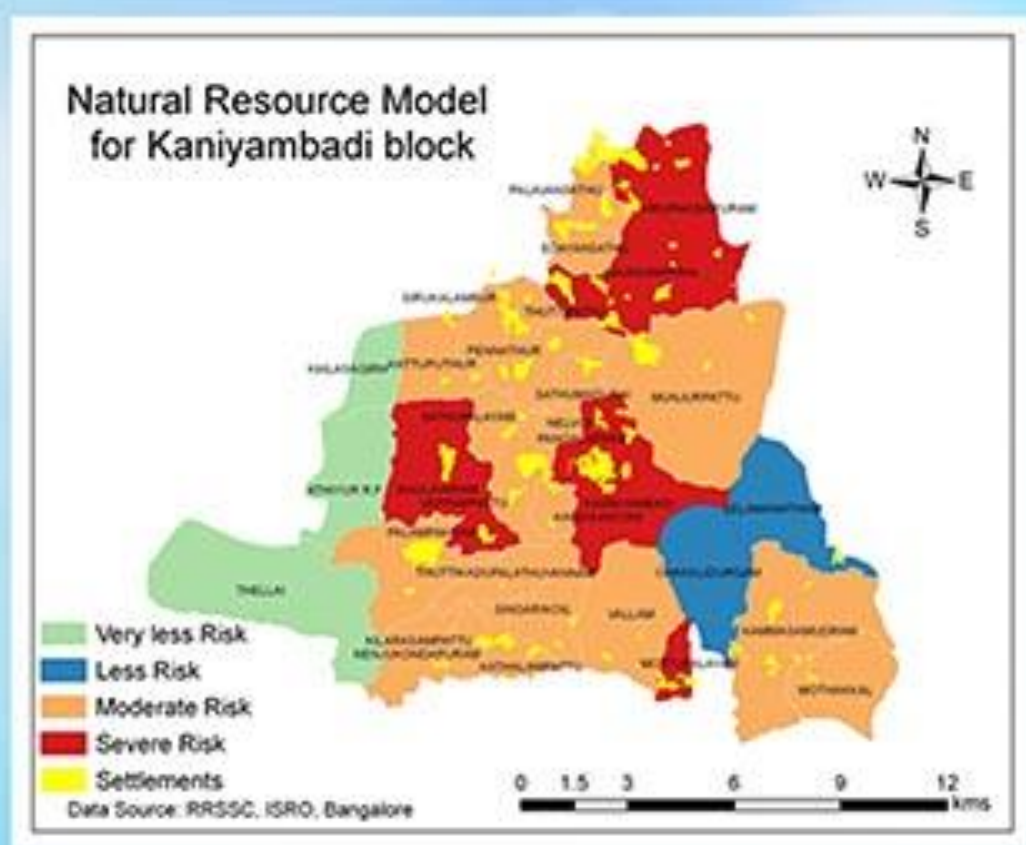


# Geographic Information Systems (GIS) in health care



**Christian Medical College**  
Vellore

# **PART I**

**AWARD APPLIED BY:**

**PRIVATE SECTOR ORGANIZATION**

# PART II

## INTRODUCTORY INFORMATION

**PROJECT NAME:** Geographic Information Systems (GIS) in health care – The CMC story

**INSTITUTE:** Christian Medical College, Vellore

**AWARD CATEGORY APPLIED FOR:** SKOCH DIGITAL INCLUSION AWARD - Health

**ADDRESS:**

Christian Medical College,  
Ida Scudder Road,  
Vellore, Tamil Nadu – 632004  
India

**Telephone:**0416-2282010

**Email:** [director@cmcvellore.ac.in](mailto:director@cmcvellore.ac.in)

**PROJECT COMMENCEMENT DATE:** 2001

**PROJECT COMPLETION DATE:** Ongoing

**DETAILS OF RESPONDENT:**

Dr. Sunil Chandy,  
Director,  
Christian Medical College,  
Vellore, Tamil Nadu – 632004  
India

**Telephone:**0416-2282010

**Email:** [director@cmcvellore.ac.in](mailto:director@cmcvellore.ac.in)

# **GEOGRAPHIC INFORMATION SYSTEMS IN HEALTH CARE – THE CMC STORY**

## **Brief overview of the project**

The Christian Medical College, Vellore (CMC) is an unaided, Christian minority health care institution which seeks to promote health and wholeness in individuals and communities, especially those who are disadvantaged, marginalized and vulnerable. The use of innovative, appropriate and cost-effective technology in order to improve health care delivery to these sections of society is central to this vision.

One of the central tenets of public health is the complex relationship between disease states and the human socio-cultural-environmental continuum. Public health solutions, in order to be successful, need to be multi-pronged, and multi-tiered. However, most initiatives are hampered by the inability to study multiple interconnected factors simultaneously – a problem of money, manpower and willpower in equal measure.

The Department of Community Health at CMC, believed that a technology called Geographical Information Systems (GIS) could provide additional insights to better understand the complexities in disease transmission and inequalities in health among communities. GIS uses geographical data to map the distribution of people, natural resources and built up structures, and had hitherto found application chiefly in agriculture, industry, civic planning and defense. CMC's involvement with GIS began in the year 2001 when an alumnus working at the Environmental Systems Research Institute (ESRI), California helped the Department of Community Health to spatially map a rural development block in Vellore district. This initiative

was later expanded to include the road networks, water, and sewage distribution systems in 82 villages of Kaniyambadi Block. More importantly, the spatial data was integrated with an existing Health and Demographic Surveillance System (DSS) for a population of over 100,000 people. This integration allowed researchers at CMC to explore spatially, the relationships between public health problems, affected populations, their living and built up environments, and climatic conditions, thus paving the way for appropriate public health interventions among the affected population.

We believe the use of GIS has improved the effectiveness of health care delivery in the target areas, and can serve as a template for replication all over India and other developing countries.

### **Challenges faced before deployment of the project**

Since the concept of GIS and its applications was totally new to CMC, the lack of technical expertise in capturing, editing, cleaning and mapping of spatial data using GIS software was a major challenge faced by researchers at the Institution. Skill acquisition has been a steep learning curve, which started initially as self-learning under guidance of an expert in the year 2001. Later, two of the interested faculty from the Community Health Department picked up additional skills by attending GIS training workshops and national level Health-GIS conferences in India. A middle level Community Health physician acquired basic skills in Remote Sensing Systems and spatial analysis during his MPH training at Tufts University, Boston, USA in 2009. Building on this, the Institution conducted a GIS training workshop in the year 2011 with focus on spatial data capturing methods, mapping, and data visualization, to equip interested researchers across the Institution with the needed skills.

## **The objectives of the project**

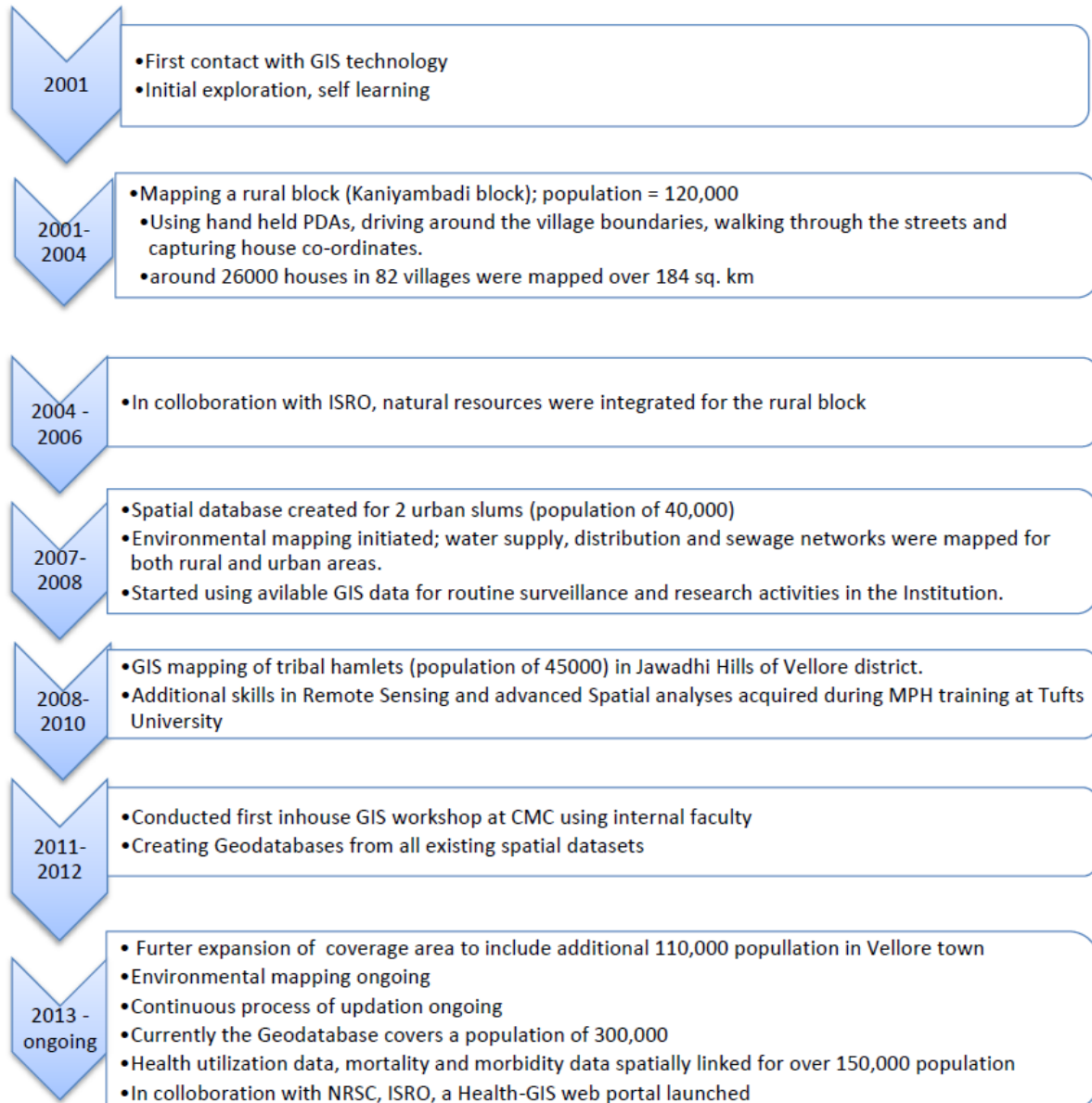
The main objectives of integrating a geospatial domain to the existing Demographic Surveillance Systems (DSS) was to better understand the epidemiology of prevalent health problems in the community, encourage and train young researchers in GIS methodologies and to apply relevant spatial analytical methods to public health related research activities undertaken at the Institution.

## **Description of the implemented project**

GIS involves the use of an information system to capture, store, analyze and display geographical data in order to inform decision making. By allowing multiple layers of data to be displayed on a single map, GIS helps to describe the spatial relationships between people, their geographical location and the distribution of characteristics or events that are of interest to investigators.

The Department of Community Health at CMC has been actively involved in studying the spatial epidemiology of commonly prevalent health conditions in order to develop analytic approaches and solutions where needed, and GIS provided the perfect platform with which to approach this problem. The flowchart given below briefly outlines the steps involved in setting up the GIS for use by researchers at CMC.

## Timeline of Health and GIS work at Christian Medical College, Vellore, India



Once the GIS was operational, the Department of Community Health applied the information obtained to study the geographical clustering of various health conditions and develop health care delivery strategies that would benefit those sections of the population at greatest risk. The various multidisciplinary projects undertaken using GIS by are summarized below.

1. A network analysis of the roads in the villages helped to optimize the routes for mobile treatment units.
2. Spatial analyses of health conditions like epilepsy, low birth weight patterns, mortality patterns etc. enabled the identification of villages at higher risk and also identified clusters and hotspots at the micro level that were targeted for intervention.
3. Important junctions on the National Highway (NH46) and stretches of the NH with higher risk of fatality were mapped by linking police First Information Report (FIR) data on road traffic accidents and geospatial data in Vellore.
4. GIS in disease outbreak investigations, such as cholera and dengue, helped identify sources, map spread, plan interventions and implement strategies to control and prevent future disease outbreaks.
5. The Division of Gastrointestinal Sciences at CMC extensively used spatial techniques in its community based research initiatives to map the etiology and spread of enterically transmitted infections among children from urban and rural communities of Vellore, and their relationship to rainfall, temperature and humidity.
6. Monitoring of drinking water quality in Vellore town and spatial exploration of relationships between the living environment, water distribution systems and sewage networks have facilitated a better understanding of the relationships between domestic

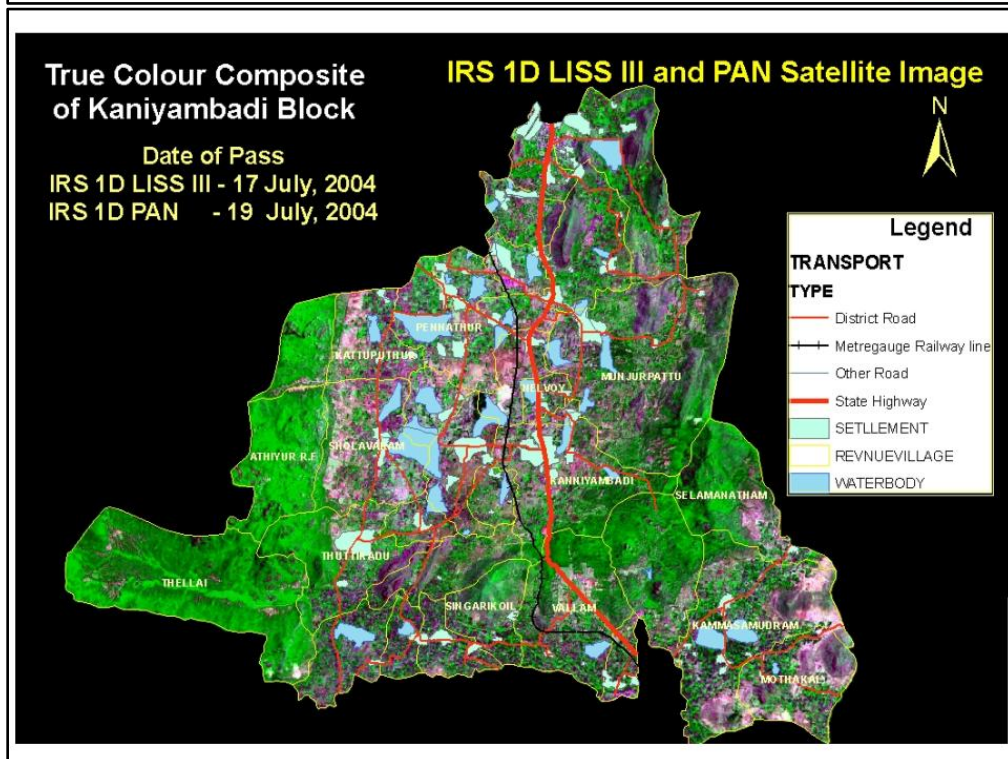
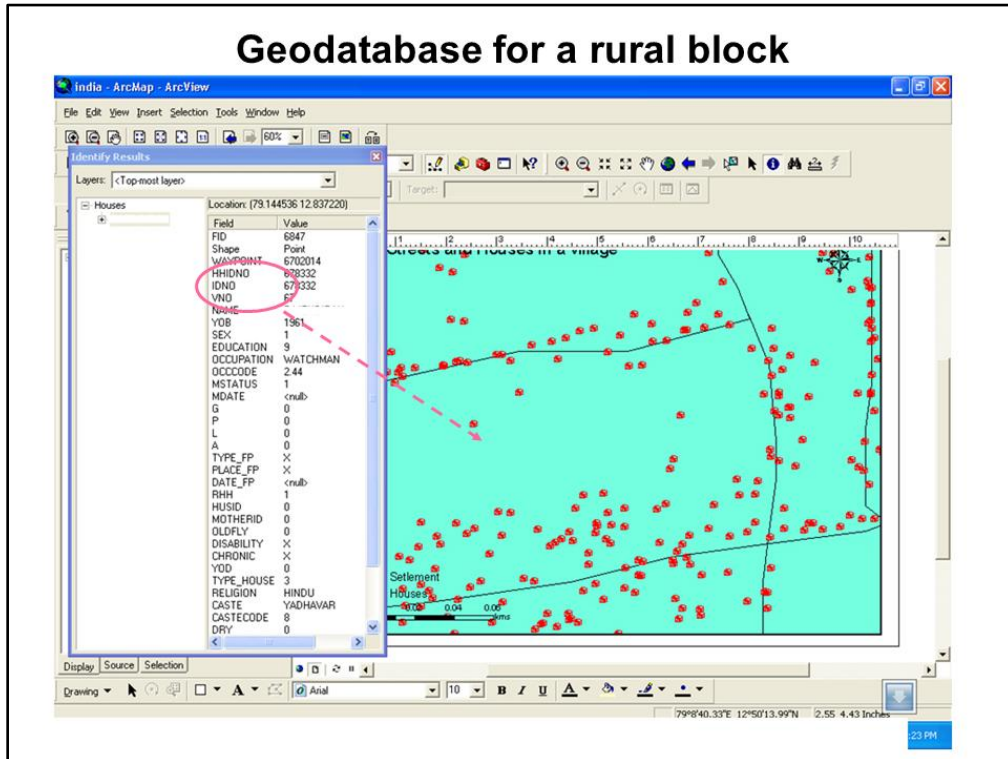


consumption of water, risk factors for contamination of piped water supply, and sewage contamination, in determining enteric infectious disease in the urban slums of Vellore.

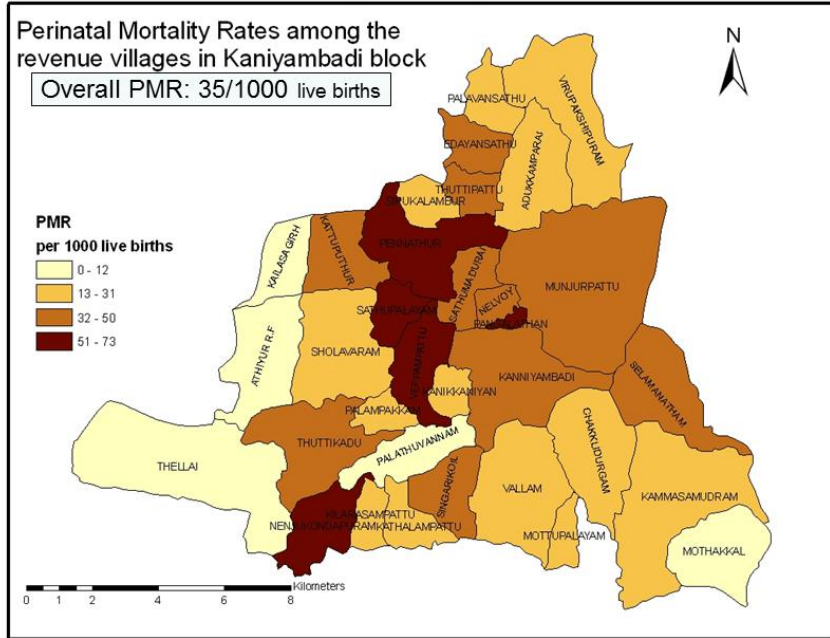
7. Combining laboratory investigation with geospatial analysis has permitted the detection of clustering of strains and emergence of new viruses that were not identified by routine methods.
8. The spatial exploration of the burden of Soil Transmitted Helminthiasis (STH) in tribal hamlets resulted in the identification of zones with higher burden of STH; this has helped in studying the associations between human behaviour, sanitation and hygiene practices and the transmission of STH in tribal areas of Vellore, which in turn has permitted planning of appropriate health interventions.
9. In collaboration with overseas partners, including Tufts University, integration of geospatial, meteorological (temperature, rainfall, humidity etc.) and health data, including human behavioral patterns, has provided further clues on the transmission dynamics of specific diseases in this region.

Thus, the use of GIS technology in CMC has been focused on identifying disease transmission pathways and designing interventions in order to reduce disease burden in the communities served by the Institution.

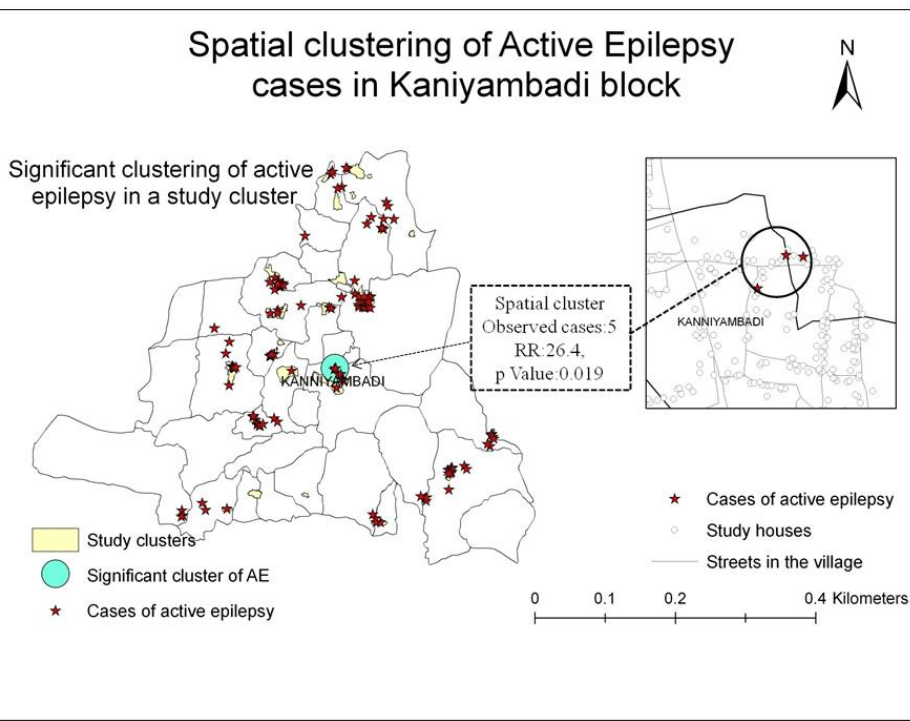
# Illustrations highlighting the application of GIS in Public Health at Christian Medical College, Vellore, India

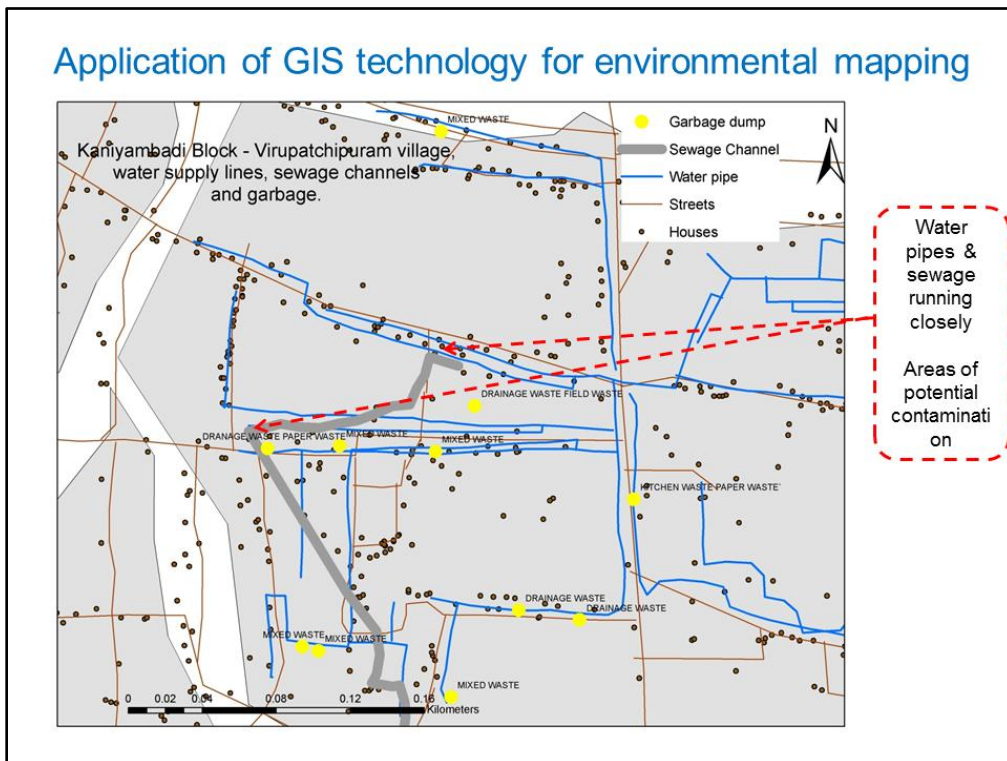
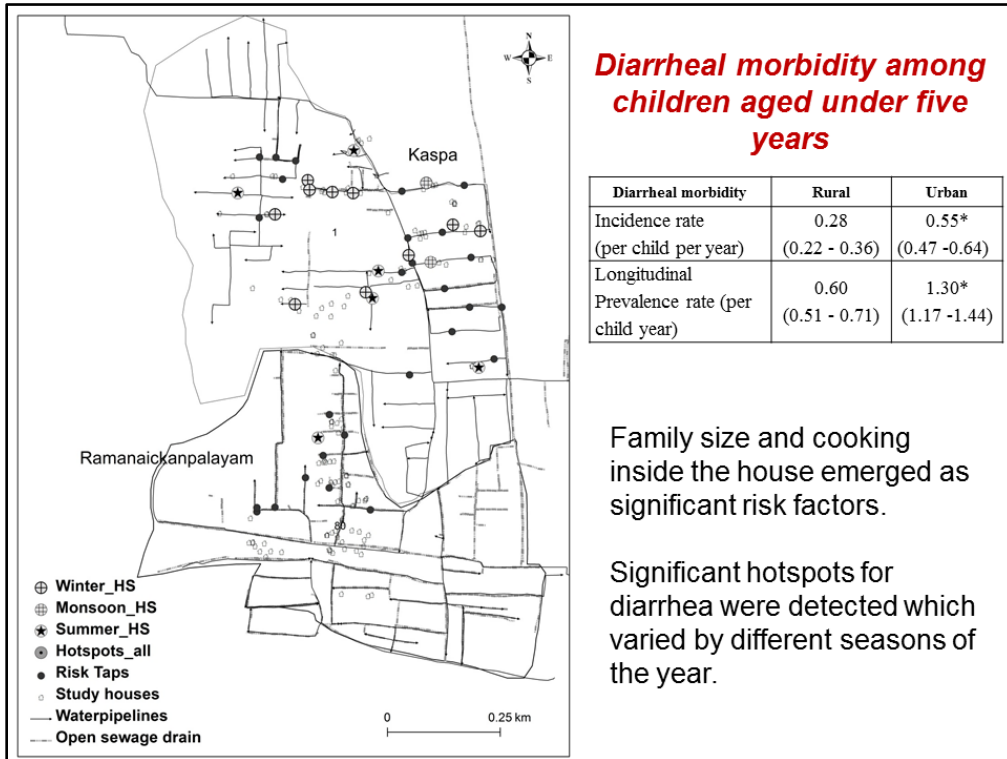


### Distribution of Perinatal Mortality Rates in Kaniyambadi block (2001-2005)



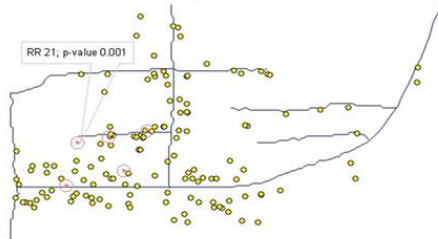
### Spatial clustering of Active Epilepsy cases in Kaniyambadi block



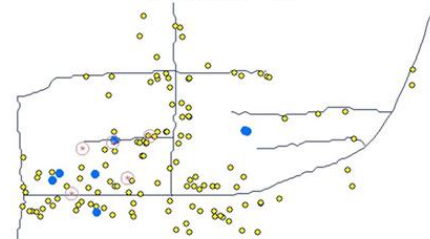


## Spatial analysis in a vector borne disease - dengue outbreak

**Clustering of cases in space and time**



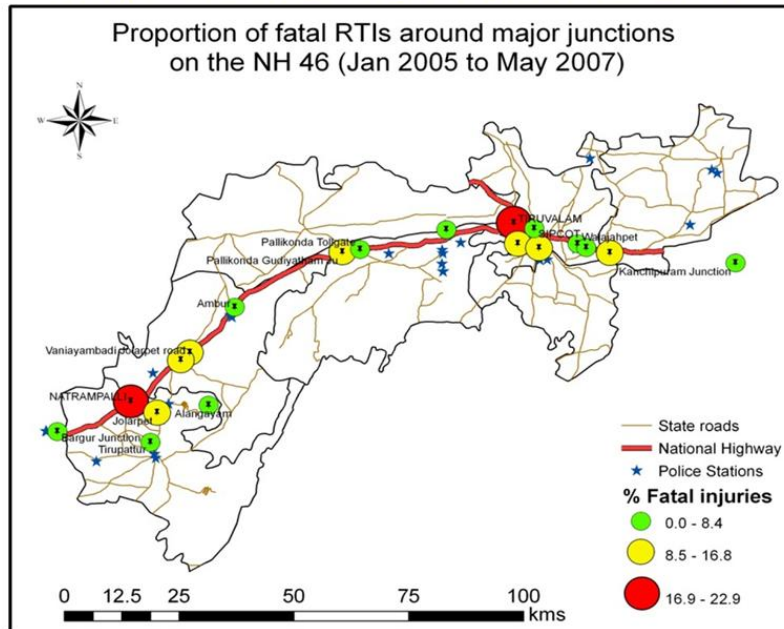
**Mosquito breeding in areas where cases were clustered**



8

## Hotspots for Road traffic injuries in Vellore

**Proportion of fatal RTIs around major junctions on the NH 46 (Jan 2005 to May 2007)**



9

## **Description of the hardware and software products, technologies and solutions deployed in the project**

The Institution has a ten user license for ArcGIS 10 software (ESRI, Redlands, CA, USA), which permits multiple users to work simultaneously across the different campuses of CMC. The software allows users to perform dynamic data visualization, spatial data management, and has the capability to perform advanced spatial analyses. Some of the spatial analytical methods which are often performed at the Institution include spatial interpolation, analyzing patterns in the distribution of health events, mapping clusters using cluster and hotspot detection, network analysis, and Geographically Weighted Regression techniques.

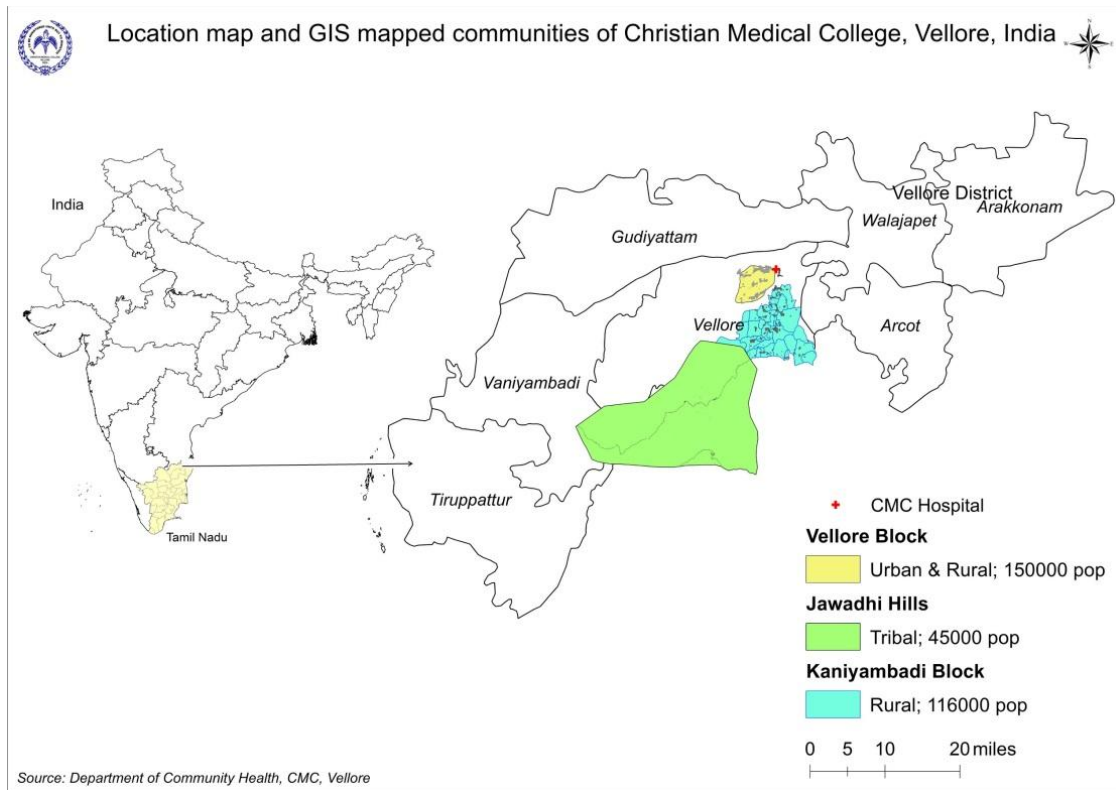
## **Details of coverage of targeted population**

Table 1 gives details of the population covered by the project across rural, urban and tribal areas, while Figure 1 gives details of the areas in Vellore district for which GIS mapping has been completed.

Table 1: Rural, Urban and Tribal populations covered under the project

<b>S. no.</b>	<b>Name of the area</b>	<b>Type</b>	<b>Area (sq. km)</b>	<b>Settlements</b>	<b>Population</b>
1	Kaniyambadi Block	Rural	184	82	116000
2	Vellore Block	Urban and Rural	17	43	150000
3	Jawadhi Hills	Tribal	3100	80	45000
Total population covered					311000

**Figure 1: Areas for whom GIS mapping has been completed**



### **Comparison of the pre-deployment scenario and the post deployment scenario**

Over the last 13 years, from being a census database with 100,000 records, the DSS and geodatabases have expanded to cover a population of over 300,000 and spans rural, urban and tribal areas in Vellore district. For over half this population, the census and health/disease indices are spatially integrated.

CMC's work on application of GIS to public health problems has been extensively published in indexed journals, a few of which are cited below:

1. Nisha V, Gad SS, Selvapandian D, Suganya V, Rajagopal V, Suganti P, Balraj V, Devasundaram J. Geographical information system (GIS) in investigation of an outbreak [of dengue fever]. *J Communic Dis*, 2005;37:39-43.

2. Sarkar R, Prabhakar AT, Manickam S, Selvapandian D, Raghava MV, Kang G et al. Epidemiological investigation of an outbreak of acute diarrhoeal disease using geographic information systems. *Trans R Soc Trop Med & Hyg.* 2007;101:587-93.
3. Ramani S, Banerjee I, Gladstone B, Sarkar R, Selvapandian D, LeFevre A, Jaffar S, IturrizaGomara M, Gray JJ, Estes, MK, Brown DW, Kang G. Geographic information systems and genotyping in the identification of rotavirus G12 infections in an urban slum with subsequent detection in hospitalized children: Emergence of G12 genotype in south India. *J ClinMicrobiol* 2007; 45:432-7.
4. Ajjampur SS, Gladstone BP, Selvapandian D, Muliyl JP, Ward H, Kang G. Molecular and spatial epidemiology of cryptosporidiosis in children in a semiurban community in South India. *J ClinMicrobiol.* 2007;45:915-20.
5. Banda K, Sarkar R, Gopal S, Govindarajan J, Harijan BB, Jeyakumar MB et al. Water handling, sanitation and defecation practices in rural southern India: a knowledge, attitudes and practices study. *Trans R Soc Trop Med & Hyg* 2007;101:1124-30.
6. Sowmyanarayanan TV, Mukhopadhy A, Gladstone BP, Sarkar R, Kang G. Investigation of a hepatitis A outbreak in children in an urban slum in Vellore using Geographic Information Systems. *Ind J Med Res* 2008;128: 32-37.
7. Raghava MV, Prabhakaran V, Jayaraman T, Muliyl J, Oommen A, Dorny P et al. Detecting spatial clusters of *Taenia solium* infections in a rural block in South India. *Trans R Soc Trop Med & Hyg* 2010;104:601-12.
8. Francis MR, Rakesh PS, Mohan VR, Balraj V, George K. Examining spatial patterns in the distribution of low birth weight babies in southern india- the role of maternal, socio-economic and environmental factors. *Int J Biol Med Res* 2012;3:1255-9.
9. Kaliappan SP, George S, Francis MR, Kattula D, Sarkar R, Minz S et al. Prevalence and clustering of soil-transmitted helminth infections in a tribal area in southern India. *Trop Med Int Health* 2013;18:1452-62.
10. Francis MR, Devasundaram J, Balraj V. Optimizing the routes and locations for primary healthcare clinics using network analysis: a geographic information systems application. *Indian J Public Health* 2013; 57(1):47-48.



## Note on cost effectiveness of the project

Table 2 gives a breakup of the approximate costs for setting up the GIS lab. The initial investment pays sustained dividends as the geospatial data so generated can be used to study the distribution and characteristics of multiple disease conditions within the same population.

No.	Items		Cost (INR)	Cost (USD)
1	Hardware	GPS Mapping units X 10	250000	4545
		Desktop computers X 2	100000	1818
		All in one Laser jet Printer	30000	545
		Server cost	300000	5455
2	Software	ArcGIS 10 institutional edition – 10 licenses	750000	13636
3	Training costs	Attending GIS workshops at Delhi- 2 members	200000	3636
	Overall		1630000	29636

*Note: Personnel and Infrastructure costs are not included*

## Details on extent of integration with other e-governance projects

In collaboration with the Indian Space Research Organisation (ISRO), a Research and Development initiative was undertaken with a team from the Regional Remote Sensing Center, Bangalore, in which health, geospatial and natural resource data at the block level were

integrated, and spatial epidemiology of common health problems were studied. As an academic center, we considered it necessary and appropriate to share our experiences with other scientists both within and outside India and our partnership with the National Remote Sensing Center at Hyderabad has enabled us to achieve this through ‘Bhuvan’, the Geoportal of ISRO. Our work applying GIS technology to better understand health problems is available for public use at <http://bhuvan-staging.nrsc.gov.in/projects/health/health.php>.

### **Details of cyber security measures in the project**

The ArcGIS 10 software runs on a dedicated research server situated in the Community Health and Training Center, Department of Community Health, CMC, Vellore. The client versions are installed on Institutional computers which are connected on a secure network throughout the Institution. The research server has its own Kaspersky antivirus program which is updated on a daily basis, has programmed security measures in place, and is inaccessible to anyone outside the network. Data on the server is made accessible only to respective authorized personnel and is continuously monitored by an administrator. Accessing internet on the client computers is possible only by logging through Cyberoam, a network security client. All GIS data is stored on a dedicated folder in the server. The research server has mirroring provision, with the entire data on the server being backed up on extra hard disks and an external storage device on a daily basis.

## **Future road map on coverage, upgradation and integration with existing systems**

The Department of Community Health at CMC hopes to widen the geographical coverage of Health & DSS information in the communities served by the Institution. A new area that is currently being studied is the spatial epidemiology of Scrub Typhus, since the morbidity and mortality associated with the disease is high in this region. We also want to strengthen the environmental component of our GIS database by adding air quality monitoring to existing Water, Sanitation and Hygiene (WASH) initiatives by collaborating with local partners and ISRO.

## **Members of the GIS application team**

The following individuals were pivotal in setting up, upgrading and maintaining the GIS work at the Institution.

	Name	Department	Specific role
1	Retd. Prof. Vinohar Balraj	Community Health	Initiating the GIS work
2	Prof. Venkata Raghava Mohan	Community Health	GIS administrator and local expert
3	Prof. Jasmine Prasad	Community Health	Program Manager for Rural and tribal areas
4	Prof. Gagandeep Kang	Gastrointestinal Sciences	Program manager for Vellore Block DSS
5	Dr. Rajiv Sarkar	Gastrointestinal Sciences, Wellcome/DBT India Alliance, middle level research fellow	Actively involved with research in urban areas
6	Mr. Mark Rohit Francis	Wellcome Trust Masters training fellow	Actively involved with research in rural and urban areas

**Venkata Raghava Mohan, M.D., MPH**  
**Professor**

**Christian Medical College**  
Department of Community Health  
Bagayam, Vellore 632002, Tamil Nadu, India  
Phone: 91416-2284207 FAX: (416) 2262268  
E-mail: [venkat@cmcvellore.ac.in](mailto:venkat@cmcvellore.ac.in)

**EDUCATION:**

1999 MBBS      Medicine, Kempegowda Institute of Medical Sciences, Bangalore University, India  
2004 MD        Community Medicine, Christian Medical College, Dr. MGR Medical University, India  
2010 MPH        Epidemiology, Biostatistics, Tufts University, Boston, USA

**ACADEMIC APPOINTMENTS:**

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Duration	Institution	Appointment
1999- 2000	Kempegowda Institute of Medical Sciences, Bangalore, India	Resident
2001- 2004	Dept. of Community Health, Christian Medical College, Vellore, India	Post graduate Registrar in Community Health
June 2004 –Sep 2009	Dept. of Community Health, Christian Medical College, Vellore, India	Assistant Professor
Oct 2009 – Oct 2013	Dept. of Community Health, Christian Medical College, Vellore, India	Associate Professor
Oct 2013 – present	Dept. of Community Health, Christian Medical College, Vellore, India	Professor
Dec 2010 - present	Dept. of Public Health & Community Medicine, Tufts University School of Medicine, Boston, USA	Adjunct Associate Professor

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## **AWARDS AND HONORS:**

- 2009 Best poster award for poster on applications of GIS in Health at Winter Symposium, CMC, Vellore.
- 2010 Runner up award at 2010 Tufts annual GIS poster exposition, Tufts University, Medford, USA.
- 2012 Best poster, Use of Remote Sensing in detecting land cover changes and trends of Malaria, ISEE, Hyderabad

## **MAJOR RESEARCH INTERESTS:**

- Geographic Information System and health applications
- Outbreak investigation and management
- Epidemiology of Taeniasolium infections in humans
- Health Information Systems
- Road Traffic Injury research
- Remote sensing technology and health applications

## **MEDICAL REGISTRATION**

- 2000 Registered with Karnataka Medical Council, India. No. 56760
- 2001 Registered with Tamil Nadu Medical Council, India. No. 67493

## **CERTIFICATIONS**

- 1999 Orissa cyclone Medical relief camp, Indian Medical Association.
- 2000 2nd National Conference on Rabies, APCRICON, Bangalore, India.
- 2002 Principles & Practice of Epidemiology, CMC, India.
- 2003 Short course on Case control study designs, CMC, India.
- 2003 Short course on Clinical Trials, CMC, India.
- 2003 Short course on Economic basis of Health care intervention, CMC, India.
- 2003 Cochrane workshop on Meta-analysis, Bangalore, India.
- 2006 Staged Diabetes Management Training program, International Diabetes Center & CMC, India.
- 2006 Training of Trainers program, IMNCI, Vellore, India.
- 2007 Geographic Information System Training Programme, CMC, Vellore, India.

2008      Analysis using Stata, CMC, Vellore.  
2008      Time series epidemiology jointly organized by CMC and InForMID, Tufts University.  
2009      Statistical principles for assessment of associations jointly organized by CMC and  
            InForMID, Tufts University.

## **RESEARCH ACTIVITIES**

- Co-investigator in a study assessing the burden of active epilepsy and neurocysticercosis in Vellore district.
- Co-investigator in a study to reduce the burden of taeniasis in Vellore district.
- Co-investigator in a study looking at insulin sensitivity patterns among low birth weight males in South India.
- Principal investigator in studies looking at road traffic injuries in Vellore.
- Co-investigator in NIH funded Mal-ED project looking at the effect of enteric infections on growth of under five children in India.
- Co-investigator in a CDC-ICMR funded study looking at “Environmental predictors of water safety and enteric infections in the vulnerable population”.
- Principal investigator in a vaccine trial looking at the safety and immunogenicity of indigenously manufactured Killed Bivalent (O1 and O139) Whole Cell Oral Cholera Vaccine.

**PUBLICATIONS: Over 25 papers in national and international journals**

## **BIO DATA**

**Name:** N. Jasmine Prasad  
**Sex:** Female  
**Date of birth:** 8.11.1959  
**Address:** Department of Community Health  
Christian Medical College, Vellore 632 002  
S. India

### **Educational Qualifications:**

MBBS	Government Medical College, Tirunelveli
MD (Community Medicine)	Christian Medical College, Vellore
Dip NB (Maternal & Child Health)	Christian Medical College, Vellore
MPH	Tufts University, USA

### **Designation**

Professor in Community Health, Christian Medical College, Vellore

### **RESEARCH ACTIVITIES**

- a) Prevalence of reproductive tract infection among young married women in rural Tamil Nadu (funded by Rockefeller Foundation).
- b) Sexual behaviour of adolescents in rural Tamil Nadu (Rockefeller Foundation)
- c) Prevalence of induced abortions in rural Tamil Nadu.
- d) Prevalence and types of domestic violence against women in rural Tamil Nadu.
- e) Community based intervention – diagnosis and treatment for sexually transmitted infections and reproductive tract infection (Rockefeller Foundation)
- f) Randomised trail on two methods of caesarian section- MisGav-LadacvsPfannenstiel
- g) Prevention of mother to child transmission of HIV in Kaniyambadi block
- h) Guide in HIV training course for Physicians

**PUBLICATIONS : 28 publications in national and international journals**

## ***Bio Data***

**Gagandeep Kang, MD, PhD, FRCPath, FAAM, FASc, FNASc**

Professor and Head

The Wellcome Trust Research Laboratory

Division of Gastrointestinal Sciences

Christian Medical College

Vellore 632 004, Tamil Nadu, India

Telephone: 91-4160-228-2052

Fax: 91-416-228-2486

*E-mail:* [gkang@cmcvellore.ac.in](mailto:gkang@cmcvellore.ac.in)

### **EDUCATION AND TRAINING**

#### **Education**

- |      |  |
|------|--|
| 1986 | Christian Medical College, Vellore, India. Degree: MBBS      |
| 1991 | Christian Medical College, Vellore, India. Degree: MD        |
| 1997 | Christian Medical College, Vellore, India. Degree: PhD       |
| 2000 | Royal College of Pathologists, London, UK. Degree: MRCPPath  |
| 2003 | FondationMerieux, France. Advanced Vaccinology Certification |

#### **Medical Training**

- |           |  |
|-----------|--|
| 1987-1988 | Jr. Resident in Ophthalmology  |
|           | 1988-1991 Demonstrator (Resident) in Clinical Microbiology, Christian Medical College, Vellore |
| 1998-1999 | Visiting Fellow, Central Public Health Laboratory, Colindale, London, UK                       |
| 1999-2000 | Visiting Scientist, Dept. of Molecular Virology, Baylor College of Medicine, Houston, TX, USA. |

#### **Professional Experience**

- |              |   |
|--------------|---|
| 2013-present | Head<br>Division of Gastrointestinal Sciences<br>Christian Medical College, Vellore |
| 2008-present | Head<br>The Wellcome Trust Research Laboratory                                      |



	Christian Medical College, Vellore
2000 –present	Professor of Microbiology Department of Gastrointestinal Sciences Christian Medical College, Vellore
1998-2000	Associate Professor of Microbiology Department of Gastrointestinal Sciences Christian Medical College, Vellore
1996-1998	Reader in Microbiology Department of Gastrointestinal Sciences Christian Medical College, Vellore
1991-1996	Lecturer in Microbiology Department of Gastrointestinal Sciences Christian Medical College, Vellore
1988-1991	Registrar in Microbiology Department of Clinical Microbiology Christian Medical College, Vellore
1987-1988	Senior House Officer in Ophthalmology Dr. Rajendra Prasad Centre for Ophthalmology All-India Institute of Medical Sciences, New Delhi

## **MEMBERSHIP IN PROFESSIONAL SOCIETIES**

Royal College of Pathologists  
 Indian Association of Medical Microbiologists  
 Indian Association of Pathologists and Microbiologists  
 Indian Society for Gastroenterology  
 Hospital Infection Society-India  
 American Society for Microbiology  
 Indian Academy of Tropical Parasitology  
 American Society for Tropical Medicine and Hygiene  
 Indian Society for Clinical Research

## **OTHER PROFESSIONAL ACTIVITIES**

2000-2007	Secretary, Hospital Infection Control Committee Christian Medical College, Vellore
2007-2009	Deputy Chairperson, Hospital Infection Control Committee Christian Medical College, Vellore
2008-2012	Vice-Principal (Research), Christian Medical College, Vellore
2012-	Member, Research Advisory Board, Christian Medical College,

Vellore.

## **PEER REVIEW ACTIVITIES**

### **Institutional Committees**

2007-2008	Member, Research Committee
2007-present	Member, Institutional Biosafety Committee
2008-2012	Deputy Chairperson, Institutional Review Board
2008-present	Member, Institutional Animal Experimentation Committee
2009-2012	Member, Institutional Animal Care and Use Committee
2008-2012	Member, Steering Committee, CMC-DBT Stem Cell Research Centre

**PUBLICATIONS:** 163 publications in national and international journals

## *Curriculum Vitae*

### **RAJIV SARKAR**

Division of Gastrointestinal Sciences, Christian Medical College, Vellore – 632 004  
Dept. Tel: +91 416 228 2052, Fax: +91 416 228 2486  
Cell Phone: +91 98940 84944, Email: rsarkar@cmcvellore.ac.in

#### **Educational Qualifications**

---

CHRISTIANMEDICALCOLLEGE (CMC) (Tamil Nadu Dr. MGR Medical University) <b>Doctor of Philosophy (Ph.D.) in Epidemiology</b>	Vellore, India  2008-2012
CHRISTIANMEDICALCOLLEGE (CMC) (Tamil Nadu Dr. MGR Medical University) <b>Master of Science (M.Sc.) in Epidemiology</b>	Vellore, India  2004-2007
NATIONAL INSITUTE OF HOMOEOPATHY (NIH) (University of Calcutta) <b>Bachelor in Homoeopathic Medicine and Surgery (BHMS)</b>	Kolkata, India  1995-2002

#### **Employment**

---

CHRISTIAN MEDICAL COLLEGE (CMC) <b>Wellcome Trust /DBT India Alliance Early Career Fellow</b>	Vellore, India May2013 – Present
CHRISTIAN MEDICAL COLLEGE (CMC) <b>Study Co-ordinator</b>	Vellore, India March 2012 – February 2013
CHRISTIAN MEDICAL COLLEGE (CMC) <b>Project Manager</b>	Vellore, India December 2009 – February 2012
CHRISTIANMEDICALCOLLEGE (CMC) <b>Senior Research Fellow</b>	Vellore, India July 2007 – November 2009

**PUBLICATIONS: 39 publications in national and international journals**

## Mark Rohit Francis BSc., MSc.

### Research Fellow

Department of Gastrointestinal Sciences, Christian Medical College, Ida Scudder Road,  
Vellore – 632 004, Tamil Nadu, India.

Cellular: +91-88709-60953, Email: [elysium28@gmail.com](mailto:elysium28@gmail.com)

#### Education/Training:

Date (mm/yyyy)	Degree	Subject	University/Institution
11/2013	MSc/DLSHTM	Epidemiology	University of London & London School of Hygiene and Tropical Medicine, London.
02/2013	PG Dip.	Epidemiology (Distance learning)	Indian Institute of Public Health, New Delhi.
04/2008	B Sc.	Zoology	Madras University, Madras Christian College

#### Academic Appointments:

Dates	Position	University/Institution
Sep 2013 - present	Wellcome Trust Masters training fellow	Department of Gastrointestinal Sciences, Christian Medical College, Vellore.
June 2010 – Aug 2012	Research Assistant	Department of Gastrointestinal Sciences, Christian Medical College, Vellore.
Aug 2009 - May 2010	Research Assistant	INCLIN Trust International, New Delhi.
May 2008 - April 2009	Visitor/Observer	Department of Community Health, Christian Medical College, Vellore.

#### Training/Certifications:

- **Community Health Programme (CHP)** - Basic Epidemiology, Health Care System Studies, and Project Planning (2008).
- **Short Course in Biostatistics** - Principles of Epidemiology, Fundamentals in Biostatistics and SPSS, CMC, Vellore (2008).
- Training Programme in **Multi-level Modelling (MLM)** and **Generalised Estimating Equations (GEE)**, CMC, Vellore (2008).
- Training Programme in **Statistical Analysis Software (SAS)**, CMC, Vellore (2008).
- Short-Courses in **Monitoring & Evaluation, HIV/AIDS, Basic and Advanced Tuberculosis, Malaria, Diarrhoea, Pneumonia, Youth Reproductive Health, Family Planning, Antimicrobial Resistance, Population-Health-Environment Programs, Vaccinations, New**

**Born Care**, USAID and John Hopkins Bloomberg School of Public Health (Online certification) (2009).

- Workshop on **Qualitative data analysis and Data entry** using CSPro and Epiinfo, MCH-Star, New Delhi (2010)
- Workshop on **Mathematical Modelling of Infectious Diseases** at IDTRC, CMC, Vellore (2010).
- Workshop on **Time Series Analysis and High Data Visualization**, CHTC, CMC, Vellore (2011).
- **Geographic Approaches to Global Health**, MEASURE Evaluation & USAID (Online certification) (2011).
- **Regional workshop on GIS in Public Health**, PHFI, New Delhi (2011).

**Publications: 8 publications in national and international journals**

**Research Interests:**

- Water, Sanitation and Hygiene interventions in developing countries
- Gastro-intestinal Infections
- Spatial Epidemiology and Geographic Information Systems  
Epidemiology of infectious diseases

# **Christian Medical College**

Ida Scudder Road,  
Vellore, Tamil Nadu - 632004  
India

Telephone : 0416-2282010  
Email: [director@cmcvellore.ac.in](mailto:director@cmcvellore.ac.in)