Geographic Information Systems for Epidemiology and Disease Surveillance Training Course

Professional Development Training Course Outline

Category	GIS	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Geographic Information Systems for Epidemiology and Disease Surveillance Training Course introduces the powerful synergy between Geographic Information Systems (GIS) and the critical fields of epidemiology and disease surveillance. In an era of increasing global health challenges, from emerging infectious diseases to the persistent burden of chronic conditions, understanding the **spatial dynamics of health** is paramount. GIS provides public health professionals, epidemiologists, and data analysts with cutting-edge tools to **visualize, analyze, and interpret geographically referenced health data**, enabling more effective **disease mapping, outbreak response, and public health intervention strategies**. This course will equip participants with the essential **geospatial analytics skills** to transform raw data into actionable insights, fostering **data-driven decision-making** and enhancing **global health security**.

Leveraging GIS in epidemiology moves beyond traditional data analysis, offering a holistic perspective on **disease patterns, environmental risk factors, and healthcare accessibility**. Participants will gain hands-on experience with **spatial data management, geocoding, spatial statistics, and cartographic visualization**, building the capacity to identify disease hotspots, predict transmission pathways, and optimize resource allocation. This training is designed to bridge the gap between epidemiological principles and advanced geospatial technologies, empowering health practitioners to lead impactful **disease prevention and control programs** and contribute to a more resilient public health infrastructure

Programme Curriculum

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Course Objectives

1. Acquire, clean, and manage diverse **spatial health datasets** for robust epidemiological analysis.
2. Create high-impact **thematic maps, hotspot analyses, and disease clusters** to visualize health outcomes effectively.
3. Perform **spatial autocorrelation, regression, and interpolation** to understand disease determinants and trends.
4. Utilize **satellite imagery and drone data** to assess environmental risk factors influencing disease spread.
5. Design and implement **GIS-based dashboards and early warning systems** for rapid outbreak detection.
6. Employ GIS for **health facility mapping, accessibility analysis, and resource planning** to address health inequities.
7. Build **spatial predictive models** to anticipate future disease incidence and inform proactive interventions.
8. Create compelling **interactive web maps and data visualizations** for effective stakeholder engagement and public awareness.
9. Utilize **mobile data collection tools (e.g., ODK)** for efficient and accurate real-time epidemiological surveys.
10. Identify and map **at-risk communities** based on socioeconomic and environmental factors for targeted interventions.
11. Gain proficiency in **QGIS** and other **Free and Open Source Software (FOSS)** for cost-effective GIS implementation.
12. Understand and apply best practices for **health data privacy and ethical GIS use** in public health.
13. Apply GIS to understand the interconnectedness of human, animal, and environmental health in **disease ecology**.

Organizational Benefits

- Gain deeper insights into disease patterns and dynamics, leading to more informed and effective public health strategies.
- Facilitate faster and more targeted responses to disease outbreaks through real-time spatial analysis and visualization.
- Ensure efficient deployment of healthcare resources, personnel, and interventions to areas of greatest need.
- Support evidence-based policy formulation and program development through comprehensive spatial health assessments.
- Empower public health leadership with robust geospatial insights for strategic planning and operational efficiency.
- Foster inter-agency collaboration and improve public engagement through clear, visually compelling spatial data communication.
- Optimize resource utilization and minimize the impact of disease outbreaks through proactive spatial monitoring and intervention.

Target Audience

1. Public Health Professionals.
2. Healthcare Data Analysts
3. Medical Researchers.
4. Environmental Health Specialists.
5. GIS Specialists in Health Sector.
6. Emergency Preparedness & Response Teams.
7. International Development & Humanitarian Workers.
8. Students & Academics.

Course Outline

Module 1: Foundations of GIS for Public Health

- Introduction to GIS concepts: layers, spatial data models (vector/raster), coordinate systems.
- Role of GIS in epidemiology and disease surveillance: historical context
- Understanding spatial thinking in public health problem-solving.
- Overview of GIS software: QGIS (open-source) and its interface.
- **Case Study:** Mapping historical cholera outbreaks to demonstrate early spatial epidemiology.

Module 2: Spatial Data Acquisition and Management

- Sources of health-related spatial data: administrative boundaries, demographic data, health facility locations.
- Data formats: Shapefiles, GeoJSON, KML, CSV, remote sensing imagery.
- Geocoding health data: converting addresses to geographic coordinates.
- Data cleaning, validation, and quality control for epidemiological datasets.
- **Case Study:** Geocoding patient addresses to map a localized disease cluster.

Module 3: Basic Cartography and Visualization for Health

- Principles of effective map design for public health communication.
- Creating thematic maps: choropleth maps, dot density maps, graduated symbol maps.
- Symbology, labeling, and legends for clear health data representation.
- Exporting maps for reports and presentations.
- **Case Study:** Creating choropleth maps of vaccination coverage rates across different administrative units.

Module 4: Spatial Joins and Data Integration

- Performing spatial joins to link attribute data with geographic features.
- Integrating diverse datasets: health surveys, environmental data, census information.
- Overlay analysis: combining multiple layers to identify areas of interest.
- Buffering and proximity analysis for health service accessibility.
- **Case Study:** Identifying populations living within a certain distance of healthcare facilities during an epidemic.

Module 5: Spatial Analysis for Disease Patterns

- Measures of spatial distribution: mean center, standard distance.
- Understanding spatial autocorrelation: Moran's I and Geary's C.
- Hotspot analysis: identifying statistically significant clusters of disease
- Analyzing spatial patterns of disease incidence and prevalence.
- **Case Study:** Identifying statistically significant hotspots of a vector-borne disease in a region.

Module 6: Environmental Epidemiology and Remote Sensing

- Introduction to remote sensing principles and applications in public health.
- Using satellite imagery for land cover/land use mapping relevant to disease vectors.
- Monitoring environmental determinants of health: deforestation, water bodies, climate indicators.
- Analyzing environmental data in conjunction with epidemiological data.
- **Case Study:** Using satellite imagery to identify mosquito breeding grounds and their correlation with malaria cases.

Module 7: Disease Outbreak Detection and Response

- Rapid mapping of incident cases during an outbreak.
- Spatial temporal analysis of disease spread.
- Developing and utilizing real-time GIS dashboards for outbreak monitoring.
- Supporting contact tracing and resource deployment with GIS.
- **Case Study:** Mapping the spread of a respiratory illness outbreak to inform isolation and quarantine measures.

Module 8: GIS for Health Service Planning and Access

- Mapping health infrastructure: hospitals, clinics, pharmacies.
- Assessing geographic accessibility to healthcare services (e.g., travel time analysis).
- Identifying underserved areas and health service gaps.
- Optimizing locations for new health facilities or mobile clinics.
- **Case Study:** Analyzing access to COVID-19 vaccination centers in rural versus urban areas.

Module 9: Predictive Modeling in Spatial Epidemiology

- Introduction to spatial regression models
- Building predictive models for disease risk based on spatial covariates.
- Forecasting future disease hotspots and vulnerable populations.
- Interpreting and validating predictive model outputs.
- **Case Study:** Predicting areas at high risk for future dengue fever outbreaks based on environmental and demographic data.

Module 10: Mobile GIS and Field Data Collection

- Introduction to mobile GIS applications for public health surveys
- Designing forms for efficient data capture in the field.
- Collecting GPS coordinates for individual cases and infrastructure.
- Integrating mobile data with desktop GIS for analysis.
- **Case Study:** Conducting a rapid assessment of water source contamination using mobile GIS devices during a cholera investigation.

Module 11: Communicating Spatial Health Information

- Principles of effective data visualization for public health audiences.
- Creating interactive web maps and story maps for public engagement.
- Developing compelling infographics and reports with spatial insights.
- Presenting GIS findings to policymakers and community stakeholders.
- **Case Study:** Developing an online interactive map to communicate Zika virus risk to the public.

Module 12: Advanced Topics in Spatial Statistics

- Introduction to geostatistics: kriging and interpolation for continuous health surfaces.
- Cluster detection methods beyond hotspots (e.g., SaTScan).
- Spatial smoothing techniques for disease rates.
- Understanding edge effects and modifiable areal unit problem (MAUP).
- **Case Study:** Interpolating air pollution levels across a city and correlating with respiratory illness rates.

Module 13: GIS for Non-Communicable Diseases (NCDs)

- Mapping prevalence and incidence of NCDs (e.g., diabetes, hypertension).
- Analyzing environmental and socioeconomic determinants of NCDs.
- Identifying disparities in NCD burden and access to care.
- Using GIS to plan NCD prevention and control programs.
- **Case Study:** Mapping obesity rates and identifying correlations with food desert locations.

Module 14: Legal, Ethical, and Data Security Considerations

- Data privacy and confidentiality in spatial health data.
- HIPAA and GDPR compliance in GIS applications.
- Ethical considerations in mapping sensitive health information.
- Best practices for data security and sharing.
- **Case Study:** Discussing methods for anonymizing health data before mapping to protect individual privacy.

Module 15: GIS in One Health and Global Health Security

- Applying GIS to understand zoonotic disease transmission pathways.
- Mapping animal health data in conjunction with human health.
- GIS for early warning systems for emerging infectious diseases.
- The role of GIS in global health initiatives and pandemic preparedness.
- **Case Study:** Using GIS to track avian influenza outbreaks in poultry farms and assess potential human exposure risk.

Training Methodology

This course adopts a highly **interactive and practical learning approach**, emphasizing **hands-on exercises** and real-world **case studies**. The methodology includes:

- **Lectures & Presentations:** Concise theoretical foundations and conceptual understanding.
- **Demonstrations:** Step-by-step guidance on GIS software functionalities and analytical techniques.
- **Practical Labs:** Extensive hands-on exercises using real and simulated public health datasets.
- **Case Study Discussions:** In-depth analysis of diverse GIS applications in epidemiology and disease surveillance from around the globe.
- **Group Activities & Problem-Solving:** Collaborative learning and application of concepts to practical scenarios.
- **Q&A Sessions:** Dedicated time for addressing participant queries and fostering deeper understanding.
- **Software Focus:** Primary emphasis on **QGIS**, with introductions to other relevant tools and platforms.

Register as a group from 3 participants for a Discount

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Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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