# INFECTIOUS DISEASE MODELING COURSE

## Introduction

This course is designed to provide participants with a practical and comprehensive understanding of infectious disease modelling and its application in public health decision-making. The programme equips participants with the knowledge and analytical skills required to understand disease transmission dynamics, predict outbreak trends, evaluate intervention strategies, and support evidence-based policy development. Participants will explore the principles of epidemiological modelling, disease transmission models, surveillance data analysis, forecasting techniques, statistical and mathematical modelling approaches, spatial epidemiology, and the use of modelling software to inform preparedness and response. The course also examines uncertainty analysis, model validation, health data interpretation, and ethical considerations in disease modelling. Through practical demonstrations, real-world case studies, hands-on modelling exercises, and group discussions, participants will strengthen their capacity to interpret modelling outputs, communicate findings to decision-makers, and support effective planning for infectious disease prevention, control, and emergency response.

## Course Objectives

- Understand the principles of infectious disease modelling.
- Explain disease transmission dynamics and epidemiological concepts.
- Apply deterministic and stochastic disease models.
- Analyze surveillance and epidemiological datasets.
- Forecast disease outbreaks using modelling techniques.
- Evaluate the impact of public health interventions.
- Interpret modelling outputs for decision-making.
- Understand uncertainty, sensitivity analysis, and model validation.
- Utilize digital tools and software for infectious disease modelling.
- Strengthen evidence-based planning for outbreak preparedness and response

## Course Modules

### > Module 1: Foundations of Infectious Disease Modelling
- Introduction to infectious disease modelling
- Basic epidemiological concepts
- Disease transmission dynamics
- Compartmental models (SIR, SEIR)
- Role of modelling in public health
- Ethical considerations in modelling

### > Module 2: Epidemiological Data and Surveillance
- Sources of surveillance data
- Data quality assessment
- Case definitions
- Data cleaning and preparation
- Descriptive epidemiology
- Visualization of epidemiological data

### > Module 3: Mathematical and Statistical Models
- Deterministic models
- Stochastic models
- Probability distributions
- Parameter estimation
- Reproduction number (R0)
- Model assumptions

### > Module 4: Outbreak Forecasting and Scenario Analysis
- Forecasting methods
- Scenario modelling
- Predicting epidemic curves
- Evaluating intervention strategies
- Vaccination impact modelling
- Non-pharmaceutical interventions

### > Module 5: Spatial Epidemiology and Advanced Modelling
- Spatial analysis
- GIS applications

- Network models
- Mobility and disease spread
- Agent-based models
- Climate and environmental influences

**> Module 6: Modelling Software and Digital Tools**

- Introduction to R for epidemiology
- Python applications
- EpiModel overview
- Data visualization tools
- Simulation exercises
- Model documentation

**> Module 7: : Interpretation and Communication of Results**

- Interpreting model outputs
- Sensitivity analysis
- Model validation
- Communicating uncertainty
- Policy briefs
- Decision support

**> Module 8: : Emerging Trends in Infectious Disease Modelling**

- Artificial Intelligence in epidemiology
- Machine learning applications
- Genomic epidemiology
- Real-time surveillance
- Future pandemic preparedness
- Developing an infectious disease modelling action plan



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