Welcome

MATHEMATICAL MODELING FOR INFECTIOUS DISEASE PLANNING IN AFRICA

(30 minutes)

UNIVERSITY OF Global Health EQUITY
HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH
CENTER for COMMUNICABLE DISEASE DYNAMICS

Welcome to all

- Welcome to the course: Emmanuel Ngwakongnwi
- Welcome to the UGHE: Designated leader
- Introductions:
  - Name, organization, areas of interest
  - If you could have one superpower, what would it be?
- Training overview: Bethany Hedt-Gauthier

Training overview

Training partnership

- **Core training team:** Caroline Buckee, Emmanuelle Dankwa, Bethany Hedt-Gauthier, Sylvia Ofori
- **UGHE advising team:** Alemayehu Amberbir, Abebe Bekele, Emmanuel Ngwakongnwi
- **Harvard advising team:** Mary Bushman, Flavia Camponovo, Megan Murray
- **Training advisor committee:**
  - Vincent Cubaka, Partners In Health/Rwanda
  - Baylie Damtie, Kepler University/Rwanda
  - Thumbi Mwangi, Center for Epidemiological Modelling and Analysis (Kenya)
  - Edison Rwagasore, Rwanda Biomedical Center
  - Sheetal Silal, Modelling and Simulation Hub, Africa (South Africa)

Training goals

- **Overall goal**
  - Build capacity among Africa-based health officials and researchers to use mathematical models to support infectious disease program response.

- **Specific course objectives**
  - Understand the fundamental concepts of infectious disease transmission and dynamics.
  - Understand the types of models and their use in public health for different infectious diseases.
  - Identify research questions suitable for mathematical modeling.
  - Critically appraise, and review modeling studies; interpret and use findings to support decision making.
  - Build models to assess the effectiveness of interventions.
  - Use routine data to support parameter decisions.

Previous courses

The training structure is adapted from previously successfully implemented Intermediate Operational Training Courses.

- 8-12 months alternating between in-person and practicum sessions.
  - 4 weeks of in-person sessions occurring every 2-5 months.

- **In-person sessions:**
  - Lectures, group and panel discussions, journal clubs, group presentations, and in-depth practical sessions with Berkeley Madonna.

- **Practicum sessions:**
  - Completed at trainee's home site.
  - Intensive mentorship will be offered in person and/or long distance.

Curriculum Overview

Week	Session title	Learning outcomes
1	Introduction to infectious disease modeling	• Know basic definitions. • Identify types of models and approaches. • Simulate the SIR model and extend it to answer basic questions and assess interventions. • Understand modeling assumptions and limitations.
2 & 3	Building mathematical models to answer research questions	• Develop models for research questions with equations. • Identify parameter values for models. • Incorporate scenarios and/or interventions into models. • Present preliminary results for projects. • Know other disease-specific compartmental models (TB, HIV, and malaria).
4	Communicating and disseminating model findings	• Effectively communicate model results to different audiences. • Explain the differences between policy briefs and research articles. • Able to draft policy briefs. • Ability to find relevant conferences and develop abstracts.

Week one- Introduction to mathematical modeling

All lectures	Activity related to lecture	Activity related to project
Why do we need mathematical models?	Guest lecture: COVID-19 math modeling in Africa	Why modeling for project?
Concepts in infectious disease epidemiology I	Defining contact and Superspreading events	N/A
Concepts in infectious disease epidemiology II	Group work on “adopt a country”	N/A
Overview of modeling structures and key components of a model	Getting started with building models- headache model exercise	Natural history of selected disease for project
Modeling assumptions and limitations	N/A	N/A
Introduction to the basic SIR model	1.SIR model for measles in a close versus open population (word doc) 2. Simulating measles model in Berkeley Madonna	Defining the SIR for your project
Introduction to basic reproduction number and epidemic thresholds	Case study on estimating Ro for a disease	N/A
Adding complexity to the basic SIR model	Modeling COVID	Defining “E” and “A” in the group project
Study teams and authorships	Panel discussion (virtual): current trends in math modeling in Africa	Who is on my team
Extending the SIR model to include compartments to assess health outcomes	COVID-19 model with deaths, hospitalization, and isolation	Health outcomes for project
Modeling interventions	COVID-19 vacccine modeling	Modeling interventions for project
Heterogeneity in mathematical modeling	N/A	N/A
Literature review and identifying parameter values for models	N/A	List parameters for the project's model
Overview of project milestones and deliverables	N/A	Finalizing research question

Deliverables and evaluation

- **Deliverable/outcome:**
  - Policy Brief.
  - Abstracts for presentations at conferences.
  - Select teams will be supported to publish their research.

- **Course evaluation**
  - A survey will be administered at the beginning, during and end of the program.

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Training hosted by the University of Global Health Equity and the Center for Communicable Disease Dynamics (Harvard)

The course will introduce participants to the basic concepts of infectious disease epidemiology and mathematical modeling; their applications to real-world problems, and the role of models in informing policies. The program is designed for participants to have hands-on experience in developing mathematical models to answer research questions to support infectious disease program response.

Eligible participants: Public health practitioners and researchers in Africa.

Training dates: Dec 5-9, 2022; March 20-31, 2023; July 24-28, 2023

Training location: Rwanda; travel and training costs will be covered.

Applications due November 5.

For more information and to apply, please visit:
ccdd.hsph.harvard.edu/rwandatraining2023/

Application process

- 875 Applications!!!
- 10 trainees (5 teams) selected:
  - 6 from Rwanda, 2 from Kenya, and 2 from Uganda
- Each team has one person with a policy/program background and another with a research background.
  - 7 trainees work with government institutions, 2 from academic organizations, 1 from NGOs.

Thank you for listening

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