Mathematical Models in Epidemiology (MME)

Dr. Maira Aguiar (BCAM)
Dr. Nicole Cusiamno (BCAM)
Dr. Damián Knopoff (BCAM)
Dr. Nico Stollenwerk (BCAM)

March 23rd – June 22nd, 2022
Wednesdays, April 13th and April 20th, 2022 – Easter Break (12 sessions)
12:00-14:00 (a total of 24 hours)

Epidemiological models are important tools to understand the dynamics of infectious diseases, contributing to public health authorities' capacity to implement the available intervention measures to control disease transmission. As the COVID-19 pandemic progressed, research on mathematical modeling became imperative and very influential, to understand the epidemiological dynamics of disease spreading and control under different scenarios. This course provides an introduction to mathematical epidemiology, from mathematical concepts and applications up to discussion of real world case studies, including the COVID-19 pandemic.

PROGRAMME
1. Mathematical concepts and applications (8 weeks)
   Intro deterministic and stochastic epidemiological models
   Stability analysis, complex eigenvalues, bifurcation diagrams, state space plots
   Basic concepts on epidemiology: reproduction number, growth rates, relative risk and vaccine efficacy
   Data on epidemiology
   Model validation with empirical data
   Model projections
   Infectious disease epidemiology
   Multi-strain models
   Chaotic dynamics
   Lyapunov exponents, predictability
   Model validation and data analysis
   Control measures (vaccination and other)
   Epidemic processes in complex networks
2. Case studies (4 weeks)
   2.a. Epidemiological concepts
   2.b. Dengue fever: multi-strain, within-host, vaccine
2.c. COVID-19 pandemic: data analysis, epidemiological measures, projections, prediction
2.d. other public health threads

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<td>Introduction to MME</td>
<td>The SIR epidemic model</td>
<td>Concepts in Epidemiology: R0 and growth rates</td>
<td>Stochastic systems</td>
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<td>Network theory</td>
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<td>The SIS epidemic Model</td>
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<td>Spatial systems</td>
<td>Bifurcation analysis</td>
<td>Parameter estimation</td>
<td>Multi-strain dengue models</td>
<td>Optimal control (vector-borne diseases)</td>
<td>Modeling COVID-19</td>
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<td>Modeling chagas disease</td>
<td>Model selection</td>
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<td>Carlo Estadaña</td>
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**PREREQUISITES:**
Basic knowledge of ordinary differential equations, linear algebra, and probabilities/statistics

**REFERENCES:**

*Registration is free, but inscription is required before March 16th, 2022: So as to inscribe go to https://forms.gle/xhqZwNmzA9YuRSKb8 and fill the registration form.*