



MATHEMATICAL EPIDEMIOLOGY AFTERNOON

OCTOBER 14th 2016, FGV Rio - Praia de Botafogo, 190, Room 307

REGISTRATION HERE: [link](#)

SCHEDULE

14:00 - 14:50: Yves DUMONT (CIRAD, France),

About Vector control and human behaviors

14:50 – 15:40: Cláudia PIO FERREIRA (UNESP)

Some new ideas and techniques in topics of mathematical epidemiology

15:40 – 16:10: Coffee-break

16:10 – 17:00: Flávio C. COELHO (FGV)

Sexual transmission causes a marked increase in the incidence of Zika in women in Rio de Janeiro, Brazil.

17:00 – 17:50: Max SOUZA (UFF)

Vector borne diseases on an urban environment

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ABSTRACTS

Yves DUMONT

CIRAD (Agricultural Research for Development) - Umr AMAP
Montpellier – France

About Vector control and human behaviors

Abstract. Whatever the Vector-borne Disease, like Chikungunya, Dengue, Zika... or Malaria, we are all convinced that Mosquito Control is one of the key strategies to lower the epidemiological risk. That is why, every year, Health agencies spend a lot of money to conduct vector control programs with, sometimes, mitigated success....

In a recent work [1], done with Josselin Thuilliez, a Health economist, we studied the interactions between vector control and human behaviors. In particular, we focused on mechanical elimination - as opposed to chemical control - techniques which, in this study, refer primarily to the physical elimination of breeding sites to reduce the mosquito population around the house (e.g. the elimination of water containers). Mechanical elimination is among the cheapest interventions mentioned above and can therefore result in high monetary returns. It is highly recommended by the WHO during inter-epidemic periods. Mechanical is also particularly interesting since it can be done either by an external agency or households in their private dwellings.

We have developed a "toy-model" mixing a very simple entomological impulsive model with a micro-economic model to show that, human behaviors may interfere in (mechanical) vector-control programs.

Keywords: Population dynamics; Vector control; Human behaviors; Cooperative system; Impulsive differential equation; Numerical simulations

References

[1] Y. Dumont, and J. Thuilliez, Human Behaviors: a threat to Mosquito Control? Mathematical Biosciences 281 (2016), page 9-23.

Cláudia PIO FERREIRA
Instituto de Biociências, UNESP

***Some new ideas and techniques in topics
of mathematical epidemiology***

Abstract. In this talk we will present and discuss some epidemiological models related to transmission and control of infections in human and animal populations. Different approaches based on differential equations will be proposed, and techniques of sensitivity analysis, and parameter estimation used. Important questions related to transmission control efficacy, in dengue, malaria and zika will be addressed.

Flávio C. COELHO
Escola de Matemática Aplicada, FGV

**Sexual transmission causes a marked increase in the incidence of
Zika in women in Rio de Janeiro, Brazil.**

Abstract. The recent emergence of Zika in Brazil and its association with increased congenital malformation rates has raised concerns over its impact on the birth rates in the country. Using data on the incidence of Zika in 2015-2016 and dengue in 2013 and 2015-16 for the city of Rio de Janeiro (pop: 6.4 million), we document a massive increase of Zika in women compared to men. Even after correcting for the bias due to the systematic testing of pregnant women for Zika, there are 90% more registered cases per 100,000 women in the sexually active age group (15-65 years) than for men but not before 15 or after 65. Assuming that infected men transmit the disease to women in their semen but that the converse is not true, some extra incidence in women is to be expected. An alternate hypothesis would be that women visit doctors more often than men. To test this, we compared the incidence of dengue fever in men and women in 2015 and in 2013 (before Zika reached Rio de Janeiro): in both years, women are 30% more likely to be reported with dengue. Summing up, women in the sexually active age bracket are far more likely to get Zika than men (+90% increase); sexual transmission is the most probable cause. Women in the 15-65 age group are also 30% more likely to be reported with dengue than men, which is probably due to women being more careful with their health.

Max SOUZA

Instituto de Matemática, Universidade Federal Fluminense

Vector borne diseases on an urban environment

Abstract. We consider a metapopulation model for an arboviral disease dynamics within a urban environment. The underlying dynamics is a coupled SIR (human)/SI (mosquito) system; notification districts are taken for patches. We focus on the role of human movement in sustaining the epidemics. It turns out that considering different aspects of urban districts leads to very heterogeneous networks, which might lead to very distinctive dynamics. In a worst case scenario, one might have local basic reproduction numbers all less than unity, but with the network basic reproduction number (R_0) larger than one. In particular, we can obtain a correction to the uniform R_0 (aggregating the data as a single region). The correction factor is given by the principal singular value of an interaction matrix. We also completely analyse the model with respect to global stability. This is joint work with Abderrahman Iggidr, Jair Koiller, Maria Lúcia Penna, Gauthier Sallet and Moacyr Silva.