Seventh Workshop Dynamical Systems Applied
to Biology and Natural Sciences DSABNS 2016
Évora, Portugal, February 2-5, 2016

FEELS RIGHT, BUT IT'S SO WRONG: THE IMPACT OF EMPIRICAL DATA ANALYSIS ON PUBLIC HEALTH PRACTICAL INTERVENTION

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ABSTRACT

Dengue fever epidemiology dynamics shows large fluctuations of disease incidence and mathematical models describing transmission of disease ultimately aim to be used as predictive tools to evaluate the introduction of intervention strategies. Recently, mathematical models describing the transmission of dengue viruses have focused on the multi-strain aspect, Antibody Dependent-Enhancement (ADE) effect and temporary cross-immunity (TCI) trying to explain the irregular behavior of dengue epidemics. A minimalistic model developed by Aguiar et al. [1] has shown rich dynamic structures up to chaotic attractors in unexpected parameter regions [2, 3], able to describe the large fluctuations observed in empirical outbreak data [4, 5]. Aguiar et al. has also shown that the combination of TCI and ADE is the most important feature to drive the complex dynamics in the system, more than the detailed number of dengue serotypes to be added in the model. In this talk, a set of models motivated by dengue fever epidemiology will be presented and the different dynamical behaviors are compared to verify how much complexity the models need to describe the fluctuations observed in the empirical data [4, 5]. Parametrized on the official notification dengue data from Thailand [6], from Brazil [7, 8] and from the recent Sanofi Pasteur vaccine trials [9], we discuss the impact of data analysis on public health practical intervention.

 ISBN: 978-989-98750-2-9

References

[1] Aguiar, M., Kooi, B., & Stollenwerk, N. (2008). Epidemiology of dengue fever: A model with temporary cross-immunity and possible secondary infection shows bifurcations and chaotic behaviour in wide parameter regions. Math. Model. Nat. Phenom.; **3**:48–70.

[2] Aguiar, M., Stollenwerk, N., & Kooi, B. (2009). Torus bifurcations, isolas and chaotic attractors in a simple dengue fever model with ADE and temporary cross immunity. Int. J. Comput. Math.; **86**:1867–77.

[3] Kooi, B.W., Aguiar, M., and Stollenwerk, N. (2013). Bifurcation analysis of a family of multi-strain epidemiology models.; **242**: 148–158.

[4] Aguiar, M., et al. (2011). The role of seasonality and import in a minimalistic multi-strain dengue model capturing differences between primary and secondary infections: complex dynamics and its implications for data analysis. J. Theor. Biol.; **289**:181–196.

[5] Aguiar, M., Stollenwerk, N. and Kooi, W. B. (2012). Scaling of stochasticity in dengue hemorrhagic fever epidemics. Math. Model. Nat. Phenom., **7**:1–11.

[6] Aguiar, M., Paul, R., Sakuntabhai, A. & Stollenwerk, N. (2014). Are we modeling the correct data set? Minimizing false predictions for dengue fever in Thailand. Epidemiology and Infection, **142**:2447–59.

[7] Aguiar, M., Rocha, R., Pessanha, J.E.M., Mateus, L. & Stollenwerk, N. (2015). Carnival or football, is there a real risk for acquiring dengue fever in Brazil during holidays seasons. Nature Scientific Reports, **5**:8462

[8] Aguiar, M., Coelho, G.E., Mateus, L., Rocha, R., Pessanha, J.E.M., Mateus, L. & Stollenwerk, N. (2015). Dengue transmission during the 2014 FIFA World Cup in Brazil. The Lancet Infectious Diseases, **10**:765–766.

[9] Mara Aguiar, Lus Mateus and Nico Stollenwerk. (2015). The currently best estimate for worldwide dengue vaccine efficacy. Accepted to be published at AIP Conference Proceedings: Numerical Analysis and Applied Mathematics - ICNAAM 2015.

 ISBN: 978-989-98750-2-9