# Be-CoDiS and Be-FAST: Mathematical models to predict the spread of human and livestock diseases with real data. Application to the 2014-15 Ebola Virus Disease epidemic and livestock diseases

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In this talk we will show recent works of our group regarding the mathematical modelling of epidemics and applications to real cases.

We will present a first version of two new deterministic spatial-temporal epidemiological model, called Be-FAST (Between Farm Animal Spatial Transmission) and Be-CoDiS (Between-Countries Disease Spread).

Be-FAST (Between Farm Animal Spatial Transmission) focuses on the spread of animal diseases between and within farms. The major original ideas introduced by Be-FAST are the study of both within and between farms spread, the use of real database and dynamic coefficients calibrated in time according to farms characteristics (e.g., size).

Be-CoDiS is a mathematical model able to simulate the spread of a human disease. It is based on the combination of an Individual-Based model (where countries are the individuals) simulating the between-country interactions (here, people movement) and disease spread, with a compartmental model (ODEs) simulating the within-country disease spread. The model coefficients are calibrated according to some country indicators (e.g., economic situation). The principal characteristic of our approach is the consideration of the following effects at the same time: people movement between countries, control measure effects and dynamic coefficients fitted to each country.

At the end of a simulation, both models returns outputs referring to outbreaks characteristics (e.g., epidemic magnitude, risk areas, etc.).

We will show some results obtained with these models, when applying them to some real cases: classical swine fever epidemics and foot and mouth disease real cases will be simulated with Be-FAST and the 2014-15 ebola epidemic will be simulated with Be-CoDiS.