

BERNOULLIS TAFELRUNDE

GRADUATE STUDENT SEMINAR

Wednesday, 30 November, 13:15-14:00
Seminarraum 05.002, Spiegelgasse 5

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Mathematical Modelling of Rabies Elimination in N'Djamena, Chad

ABSTRACT

Rabies is a viral disease that is transmitted by bite and is fatal after the onset of symptoms. In Africa and Asia, the domestic dog is the primary vector for human rabies. Mass dog vaccination is therefore considered as the most effective path to rabies elimination. In 2012 and 2013, two dog vaccination campaigns were conducted in N'Djamena, Chad, reaching a vaccination coverage of more than 70%. The campaigns interrupted transmission for several months but there has been a resurgence, earlier than predicted by homogeneous models of rabies transmission. We developed a deterministic model that includes spatial heterogeneity and importation of latent dogs. Heterogeneity was incorporated by dividing the city into patches with a system of ordinary differential equations in each patch. The model parameters were fitted to four years of weekly incidence data. Sensitivity analysis of the model suggests that underreporting of cases is unlikely to lead to the early resurgence. Incorporating heterogeneity shows that the reproductive ratio is underestimated in homogeneous models. However our simulation results suggest that while spatial heterogeneity seems to facilitate the fast re-establishment of rabies in N'Djamena, the main cause for the recent cases is importation. Vaccination campaigns should therefore also consider the rural surroundings of a city. If high vaccination coverage around the city could be achieved and maintained it may even be possible to eliminate rabies without vaccinating in the city itself.