2017_77: Integrating human and wildlife health: the case of nonfatal rabies in Africa

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Policymakers increasingly recognise the public health impact of zoonotic diseases such as avian influenza and SARS. At the same time, conservationists increasingly recognise the impact on endangered wildlife of diseases such as chytridiomycosis and canine distemper. In some cases, the same pathogens threaten both human and wildlife health: for example Ebola has caused mass mortality in both people and gorillas.

Rabies is a major threat to human, livestock, and wildlife health. Persisting mainly in domestic dog populations, rabies kills an estimated 60,000 people a year, and has also devastated populations of endangered species such as Ethiopian wolves and African wild dogs.

Rabies has major impacts because it can cause extremely high mortality, a pattern which characterises its epidemiology. Nevertheless, experiments show that some domestic dogs can abort rabies infection, becoming immune to subsequent challenge (1). In parts of Africa, a high proportion of unvaccinated domestic dogs, and wild carnivores, have circulating rabies antibodies (e.g., 2, 3) suggesting that such nonfatal exposure may be commonplace. Such acquired immunity could alter estimates of the vaccination coverage needed to control rabies; however models of rabies dynamics typically do not include acquired immunity (e.g., 4).

This project will explore the implications of nonfatal rabies exposure for efforts to protect human and wildlife health in East Africa. Combining mathematical modelling with fieldwork at an existing study site, where domestic dog vaccination is being expanded across a site with long-term monitoring of African wild dogs (5), the studentship will address four questions:

(i) Are naturally seropositive domestic dogs immune to rabies? This question will be addressed by blood-sampling domestic dogs before, and shortly after, routine vaccination, to seek evidence of anamnestic responses in seropositive dogs.

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(ii) In modelled domestic dog populations, how does including acquired immunity influence rabies dynamics, including projected outcomes of sustained and sporadic vaccination campaigns?

(iii) Does domestic dog vaccination reduce exposure to rabies virus in African wild dogs? This question will be addressed by screening existing and newly-collected blood samples from wild dogs, as domestic dog vaccination expands across the study area.

(iv) In modelled African wild dog populations, how does including an immune class influence rabies dynamics? Does sustained or sporadic domestic dog vaccination benefit wild dogs by reducing rabies exposure, or harm them by reducing natural immunization?