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The "URBAN ZOO" Newsletter

NOVEMBER ,2015

Quarterly Newsletter on "Epidemiology, Ecology and Socio-Economics of Disease Emergence in Nairobi"

Co PI's Letter: Microbiology Thread

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URBAN ZOO PROJECT

Urban Zoo is an interdisciplinary programme focused around the role of urbanization in the emergence of zoonotic pathogens. We are funded by the Environmental and Social Ecology of Human Infectious Diseases initiative (ESEI), a joint UK Research Council initiative which is part of the Living With Environmental Change Programme.

Prof. Mark Woolhouse

On a dark and cold November afternoon, Edinburgh feels very far from Nairobi and the UrbanZoo project. But I like to think that we still have a useful contribution to make, not least by helping to put together different pieces of research together to reveal the "big picture". It is going to be a very unusual picture though; we want to construct a kind of map of Nairobi from the point of view of a ubiquitous bacterium, *Escherichia coli*. We want to find out where different strains of *E. coli* live and how they move through the different compartments that make up Nairobi: healthy people in the community, sick children in clinics, wildlife, food, water and waste and especially the livestock species that live in the city.

Those urban livestock are central to UrbanZoo: we want to know how they fit into the ecology of *E. coli* in Nairobi and, in doing so, we hope to illuminate a general theme of the entire ESEI programme (of which UrbanZoo is one of 3 funded projects). We will be testing the idea that urban livestock are a risk factor for outbreaks of emerging diseases (not just *E. coli*-related disease) in cities everywhere. Though often stated, that hypothesis has rarely been tested. It might not even be true: we shall see.

It all starts with the highly structured collection of samples by the field teams, who are systematically working their way around Nairobi as they conduct the 99 Household survey. The microbiology teams will then give us a first glimpse of the big picture by carefully typing the *E. coli* isolated from those samples. That work is vital, but although standard typing methods can tell us whether two samples share similar kinds of *E. coli*, they often cannot tell us the direction of movement. For example, if samples from a child and a pig in the same household contain very similar *E. coli*, does it mean that the pig infected the child, the child infected the pig, or they were both infected from some other source? The state-of-the-art tool for answering those questions is a kind of statistical analysis called phylodynamics. Our phylodynamic analyses will use two kinds of information: whole genome sequences of UrbanZoo *E. coli*; and the metadata - place, time and host species in particular - that go with those sequences.

That is why everyone is working so hard to obtain the best possible set of isolates for sequencing and all the field and typing data that go with them, why we are spending so much money on whole genome sequencing, and why Melissa Ward is devoting so much of her time to doing the phylodynamics analyses. Over the next 12 months or so we hope to build up a collection of *E. coli* sequences that is by far the best of its kind in the world and that gives us completely new insights into the ecology of the bacterium within the extremely complex ecosystem that is Nairobi. We hope to reveal a picture that no one else has ever seen before. I can't wait.

Mark Woolhouse is Professor of Infectious Disease Epidemiology at the University of Edinburgh in Scotland.

http://www.vqe.vet.ed.ac.uk/epigroup/Mark_Woolhouse.html

Urban Zoo Partners:

University of Liverpool · ILRI International Livestock Research Institute · Kenya Medical Research Institute KEMRI · UCL · RVC Royal Veterinary College University of London · University of Nairobi · The University of Edinburgh · iied · APHRC African Population & Health Research Center

Urban Zoo Team – Out and About

ISVEE–3rd to 7th November 2015

Photo for the group members at the conference venue

The International Symposium for Veterinary Epidemiology and Economics (ISVEE) 14th conference was held in Merida, Yucatan in Mexico from 3rd to 7th November 2015.

The Urban Zoo group was well represented by Patrick Muinde, Pablo Alarcon, Paula Dominguez, Maud Carron, Joshua Onono, Judy Bettridge, Annie Cook and Jonathan Rushton.

The theme of the conference was "Veterinary Epidemiology & Economics: Planning our future" and this group gave oral presentations in several streams in the conference, including presenting much of the work on value chains; but also gave talks on food nutrition, zoonoses, animal health economics, statistics and food safety.

In addition to having some excellent talks, the social side of the conference was also highly enjoyable, with many opportunities to sample local food and see some of the historical sites around Yucatan. This also provided a chance to meet and discuss science with colleagues from around the globe.

All about Pork– Safe Pork Conference

The 11TH Safe Pork conference was held from 7th to 10th September 2015 in Porto, Portugal. The Urban Zoo project was represented by Dr. Maurice Karani of ILRI and Dr. Pablo Alarcon of RVC.

The conference focused on the epidemiology and control of foodborne pathogens and antimicrobial resistance in pigs and pork along all production chains. Additionally, international exchange of ideas, research and policy themes related to the management of zoonosis and food safety in the pig and pork sector, with an integrated approach from "farm to fork" in relation to the "One Health" concept was explored

Our highlight of the conference was the oral presentation by Maurice Karani, a veterinarian and a research assistant with the urban zoo project and an MSc student at the Royal Veterinary College titled, '**Assessing and understanding food safety risk practices in Nairobi pork food system: a value chain approach'.** The presentation was awarded the best oral presentation in the student category.

The work on Nairobi's pig value chain, one of several Urban Zoo value chain outputs, will be published in 2016.

Dr. Maurice Karani making his presentation

Allan Ogendo: Consultant– Wildlife Veterinarian for the 99HH study

Dr. Allan Ogendo

Dr. Allan Ogendo is a consultant wildlife veterinarian working in the UrbanZoo project and specifically looking at the ecology of disease emergence in peri-domestic wildlife species in the city of Nairobi, Kenya. We are involved in ecological sampling techniques, habitat mapping and sample collection of rodents, bats, scavenging birds, primates and meso-carnivores.

He is a Veterinarian, a graduate of 2009 from the University of Nairobi, currently employed by the Ministry of Agriculture, Livestock and Fisheries, and also undertaking a Masters' degree in Applied Epidemiology at the Jomo Kenyatta University of Agriculture and Technology (JKUAT) under the Field Epidemiology and Laboratory Training Programme (FELTP)

More info about Allan to be found in our website http://www.zoonotic-diseases.org/who-we-are/currentstaffstudents/allan-ongendo/

URBAN ZOO PROJECT: The 99 Household Study

The 99 households study is now well under way, with sampling being carried out across a range of neighbourhoods in Nairobi. Each week the team targets a different sub-location, where three households are recruited; two with different types of livestock and a third which does not keep any livestock species. Our team of clinical officers and vets collect samples from all human members of the household, along with samples from livestock present, from the general household environment and from any animal source foods in the home. In addition, the wildlife team trap and sample rodents, wild birds, bats, primates and small carnivores in the vicinity.

Using a tablet to collect data

Sampling a rabbit in Makongeni

Sampling a household is intensive, and participants not only consent to donate their faeces to the study, but also give up a good portion of their time, answering questionnaires, aiding the sampling by handling their livestock, and providing access to their property at all hours to allow checking of rodent traps. As such, only three households are sampled in a week, but after 8 weeks more than 400 samples have already been collected.

All samples are sent to our two collaborating laboratories at KEMRI and the University of Nairobi, where they are cultured to grow *E.coli* bacteria, the primary focus of the study. Multiple individual bacterial colonies are selected from the first culture to go forward for purification and further testing. This means that each animal, human or environmental sample taken in the field can generate up to five subsequent bacterial isolates, and so the number of colonies in the collection is increasing rapidly.

Genetic data from the bacterial samples will allow us to study similarities and differences between these normal bacteria carried by individuals, and how they can be shared between humans, animals and the environment. The questionnaire data collected, among other things, builds on the project's previous work on value chains, and will allow us to assess how these consumers from a range of social strata are connected to the various value chains that exist in Nairobi for meat and animal products.

Field team in one of the sampling sites

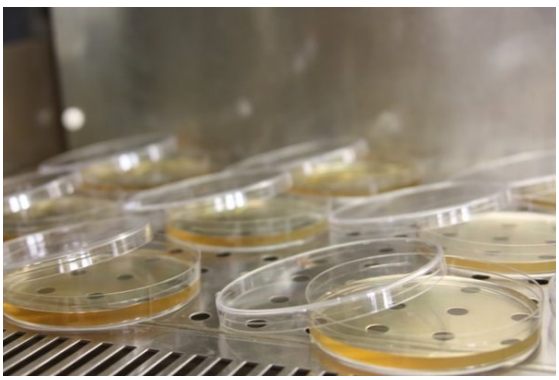
A great deal of work has led up to the start of this study, including developing strategies for finding participants to represent a diverse section of the city, developing sampling and laboratory protocols, and designing the electronic data capture systems used in the field and laboratories. Everyone involved is delighted that things are now up and running and our colleagues in the UK are eagerly waiting for the first shipment of bacterial DNA to arrive. Watch this space!

The 99 Households Study is part of the Urban Zoo Project http://www.zoonotic-diseases.org/project/urban-zoo-project/ which is a joint project between scientists from Kenya and the UK. We are interested in how diseases can be transmitted between animals and people living in close contact in a city environment.

The 99 Household study aims to collect in-depth information from 99 families from 33 different neighbourhoods stratified by socio-economic status across the whole of Nairobi. We are testing humans, animals and the home environment for bacteria that can be shared and spread between them.

Sampling the environment

Field samples move from rather dirty environs to the lab as below:



Microbiology plates in readiness for culturing samples

This article has been written by Judy Bettridge (Post Doc under the 99HH Study, based jointly between the University of Liverpool, UK and International Livestock Research Institute (ILRI) in Kenya).

Wildlife Component - 99 Household Study

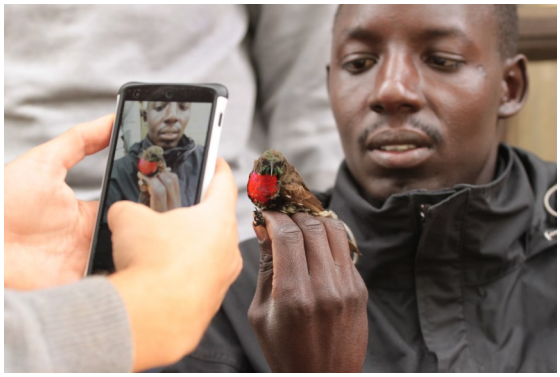


Photo by the team

To complete the One Health picture in the Urban Zoo project is the wildlife thread, an exciting arm of the project and a perfect mix of science and adventure! This focusses on the role of syanthropic wildlife (species that live in close association with humans including birds, rodents, bats and primates) in the epidemiology of disease emergence.

The project involves trapping, ecological sampling, habitat mapping and sample collection and it also gives a clear picture of the diversity and distribution of the syanthropic wildlife in Nairobi. By use of molecular epidemiology, we will be able to investigate the potential transmission pathways of organisms, with E. coli as an example, between the species of wildlife and humans. Various humane trapping methods are used to capture the wildlife as follows:

Birds are trapped using special mist nets which are mounted at dawn along the birds' flight pathways. Once a bird flies into the net, it gets entangled. It is then removed gently and sampled by a team of professional vets before being released.

Bats also have a special type of mist net which is mounted at dusk along their presumed pathways. The bats then fly into the net and are removed for sampling.

Photo of a bat we sampled

Rodents are trapped using non-lethal shearman traps which are baited by the aromatic small fish commonly referred to as 'omena'. These traps are left in each household for up to three nights but are checked twice daily.

Primates on the other hand are trapped using a special type of trap in coordination with the Kenya Wildlife Service team with which we work together.

So far, various species of bats such as Epomorphus weighing about 200 grams and the 7 gms *Scotophilus* have been caught. The most predominant rodent species in Nairobi is the common house mouse '*Mus*' followed by the *Rattus* spp. House sparrows seem to have colonized the birds' kingdom in Nairobi going by our statistics. Red-billed firefinch is the second most common bird in parts of Nairobi. To enrich and diversify our sampling, two Sykes Monkeys were also trapped and sampled.

All the birds and primates are sampled and released back to their natural habitat; some bats are sampled and released whereas others are taken to the lab for full postmortem. All rodents are taken for full postmortem in ILRI's state-of-the-art BSL 3 laboratory. More of our working in BSL 3 coming in the next newsletter!!

Article written by : Allan Ogendo

Recent Publications

Animal production and antimicrobial resistance in the clinic; Timothy P Robinson, Heiman F L Wertheim, Manish Kakkar, Samuel Kariuki, Dengpan Bu, Lance B Price Published Online November 18, 2015 http://dx.doi.org/10.1016/PII The Lancet

Methodological Framework for World Health Organization Estimates of the Global Burden of Foodborne Disease. Devleesschauwer B, Haagsma JA, Angulo FJ, Bellinger DC, Cole D, Döpfer, D, Fazil, A, Fèvre, EM, Gibb, HJ, Hald,T, Kirk, MD, Lake, RJ, de Noordhout, CM, Mathers, CD, McDonald, SA, Pires, SM, Speybroeck, N, Thomas, MK, Torgerson, PR, Wu,F, Havelaar, AH, Praet, N (2015). PLoS ONE 10(12): e0142498. doi: 10.1371/journal.pone.0142498

World Health Organization Estimates of the Global and Regional Disease Burden of 11 Foodborne Parasitic Diseases, 2010: A Data Synthesis- Torgerson PR, Devleesschauwer B, Praet N, Speybroeck N, Willingham AL, Kasuga, F, Rokni, MB, Zhou, X-N, Fèvre, EM, Sripa,B, Gargouri,N, Fürst,T, Budke,CM, Carabin,H, Kirk, MD, Angulo, FJ, Havelaar, A, de Silva, N (2015). . PLoS Medicine 12(12): e1001920. doi: 10.1371/journal.pmed.1001920

A Putative, Novel Coli Surface Antigen 8B (CS8B) of Enterotoxigenic Escherichia coli. Pathogens and Disease. Njoroge S.M., Boinett C.J., Made L.F., Ouko T.T., Fevre E.M., Thomson N.R., Kariuki S. (2015) doi: http://dx.doi.org/10.1093/femspd/ftv047

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www.zoonotic-diseases.org

UPCOMING EVENTS:

- Urban Zoo Annual Meeting, at Royal Veterinary College, University of London; 19th and 20th January, 2016
- 17th International Congress on Infectious Diseases conference (ICID) in Hyderabad, India, from the 2nd to 5th March 2016. http://www.isid.org./icid/welcome.shtml
- Annual Meeting of the Society for Veterinary Epidemiology and Preventive Medicine (SVEPM) to be held 16-18 March 2016 in Elsinore, Denmark. http://svepm2016.org/
- One Health for the Real World: zoonoses, ecosystems and wellbeing symposium scheduled for 17 Mar - 18 Mar 2016. Registration through: www.zsl.org/science/whats-on/one-health-for-the-real-world-zoonoses-ecosystems-and-wellbeing

MRC Medical Research Council | BBSRC bioscience for the future | E·S·R·C Economic & Social Research Council | NERC | Living With Environmental Change LWEC