



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

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Dr. Tim Robinson

One of the primary objectives of the Urban Zoo project is to quantify and understand microbial diversity in an urban setting and to try and link that to urban livestock keeping. In so doing we aim to elucidate the possible role of livestock as a risk factor in the emergence of disease in cities.

To give us a handle on microbial diversity we have chosen commensal *Escherichia coli* as an indicator species, which we have isolated from samples taken from a diversity of sources across the city of Nairobi. These comprise people and their living spaces, including the food they eat; their immediate environments, including water sources, waste and wildlife; and the livestock that they keep either for their own consumption or for sale. From these samples we isolate and culture *E. coli*, extract their DNA, and perform whole genome sequencing, enabling us to compare isolates from different compartments and to determine how closely related they are, and thus how microorganisms

might pass from one to another.

The collection of these samples has been guided by a highly structured sampling frame, which I described in newsletter number 7. Essentially, we have selected 33 sub-locations in Nairobi representing a range of social strata and, within each, have chosen 3 households to sample: one with no livestock; one with only monogastric species (pigs or chickens); and one with ruminant livestock (sheep, goats or cattle).

The collection of such comprehensive data from these 99 households was an enormous undertaking and has been a considerable logistical feat of coordination between the field and the laboratory. The good news is that the sampling is now complete, thanks to the heroic efforts of the field team, led by Judy Bettridge and James Akoko, and of our colleagues in the laboratories.

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.

Overall, 2,351 samples have been collected and we managed to culture *E. coli* from 80% of these (1,850). Once the last few have been done this will give us 1,809 whole genome sequences to analyse. 327 of these are from people; 58 from the places where they prepare food; 64 from animal source foods (milk meat and eggs); 644 from 12 different species of livestock; 239 from the environment around the home-
stead including water sources; and 477 from a wide diversity of wildlife in the vicinity of the household.

But it is not over yet. We will very soon have finalised the sequencing and now comes the equally challenging task of deciphering all of this genetic data to unveil the pattern of microbial diversity across Nairobi. Over to you Melissa!

On that note, I would like once again to congratulate the field and laboratory teams, and to wish everyone a great year ahead, 2017.

Timothy Robinson is a principal scientist with ILRI's Livestock Systems and Environment research group. <https://www.ilri.org/users/trobinson>

Visualizing the year 2016 - fieldwork activities



Samples were collected from a variety of livestock and wildlife in different parts of Nairobi, and in varied environments; the dedicated field teams had to beat all odds to get samples from cows, goats, pigs, sheep, genea fowls, genea pigs, ducks, pigeons, chicken, birds, rodents, monkeys, and bats, amongst other animals, as well as environments and people.



Personal protective clothing and the general biosecurity was observed



Capacity building of interns, graduate fellows and food venders was effectively achieved



Urban Zoo Graduate Fellows



Dr. Josephat Mbai



Dr. Jeremiah N. Ngugi



Dr. Erick Orimbo

Josephat, Jeremiah and Erick are all veterinarians working under the Director of Veterinary Services (DVS), Ministry of Agriculture, Livestock and Fisheries and are currently pursuing their MSc at Moi University under Kenya Field Epidemiology and Laboratory training program (K-FELTP). They are graduate fellows with the ZED Group (www.zoonotic.diseases.org)



A Great Research Experience



MSc Students, Caren Ndeti

I joined the International Livestock Research Institute (ILRI) in February 2015 as my placement site under the Kenya Field Epidemiology and Laboratory Training Program (FELTP) together with two of my colleagues; Isaac Ngere and Maurice Omondi and under the supervision of Prof. Eric Fevre. It has been an amazing two-year experience with diverse exposure to the research world. Together with the other FELTP residents, we learned how to analyze field data using different software's and through the graduate fellow journal clubs, we became better oral presenters. We had a great time evaluating surveillance systems relevant to zoonotic diseases in Western Kenya. I was attached to the Urban Zoo project and my MSc research was on the Dairy Value Chain where I worked with Dr. Stella Kiambi (PhD).

Under the Dairy Value Chain, I was involved in characterizing of antibiotic residues in milk at the farm level. The study was conducted in Uthiru Location, which is a peri-urban farming area spanning between Kiambu and Nairobi County. It was a cross sectional study with the aim of investigating the prevalence of specific types of antibiotic residues and their concentrations. This involved visiting dairy farms as early as 6 a.m. to collect milk samples and transporting them to the University of Nairobi, Public Health, Pharmacology and Toxicology (PHPT) Laboratory for storage and testing. With the help of Dr. Stella Kiambi and Mr Masinde, we were able to collect samples from the farms and from the different nodes along the Dairy Value Chain. We screened for Sulphonamides, Tetracyclines and Beta Lactams.

The laboratory work would start immediately with the help of the laboratory personnel. Mr. Masinde from the University of Nairobi, PHPT Labs was very helpful during screening and Mr. Nderitu, also from the same labs helped with the more technical High Performance Liquid Chromatography (HPLC) tests. The laboratory experience was awesome; samples running up to late night and even sometimes working overnight! Working over the weekends was the norm especially due to the long HPLC processes.

The results of this research are yet to be published but we demonstrated the presence of antibiotic residues up to 26% prevalence in the milk sampled at farm level. I highly appreciate the support I received from the ILRI team led by Prof. Fevre and the Project manager Dr. Victoria Kyallo. The field and the lab teams were also very supportive. You all made a great team!

This article has been written by Caren Ndeti (MSc student, FELTP Program, based jointly between Moi University and International Livestock Research Institute (ILRI) in Kenya).

Mapping Nairobi's Dairy Value Chain

The dairy food system is considered one of the most crucial systems to improve food security in Nairobi, with the rapid population growth providing an increased challenge. We utilized the Mapping component of the Value Chain Analysis to describe the structure of the Nairobi's dairy value chain.

Cross sectional data were collected in focus group discussions and key informant interviews with dairy farmers, retailers, traders, dairy cooperatives, large processing companies, policy makers and regulators to obtain qualitative information on type of people and products in the chains, their interactions and to quantify existing chain flows.

The study was done through a complex qualitative analysis: 1) thematic analysis, which was used to identify emerging themes explaining flows or identifying activities; (2) combining emerging themes and flowchart created by participants to create the final profiles for each system segment, (3) use of quantitative data obtained to assess importance of flows.

The results showed that the Nairobi's dairy value chain is vast and complex with some degree of interlinkages between the formal and informal systems (Figure 1). Although the city's dairy market is enormous, the chains depend on small scale individuals who mainly operate singly. If assessed in their individual capacity they may appear insignificant, but keen scrutiny reveal the niche created by each of them to form the overall complex dairy value chain.

In conclusion, while we appreciate the need to enhance milk production to meet the current and the anticipated demand for dairy products, opportunities for expanding production in the city are dim owing to the prevailing circumstances among them the diminishing land for expansion of the dairy farming and insufficient utilization of the modern technologies to enhance production. Alternative sources should therefore be enhanced to ensure adequate supply of the city residents.

This article has been written by Stella Kiambi, a PhD student based jointly between University of Nairobi (UoN) and International Livestock Research Institute (ILRI) in Kenya

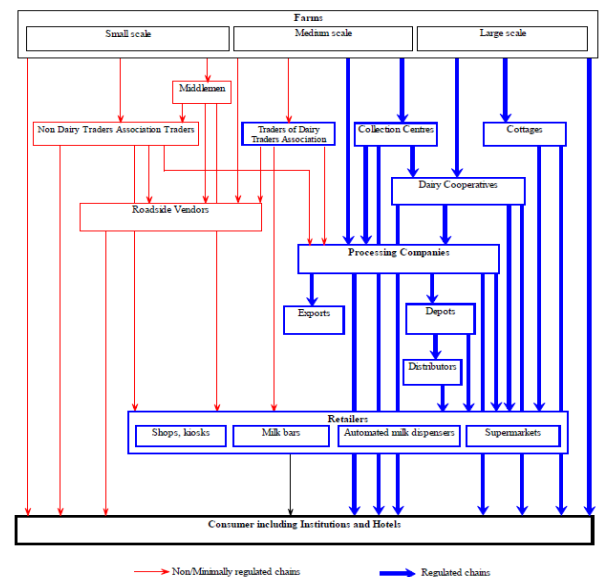


Figure 1: General Chain profile for dairy value chain in Kenya

Recent Publications:



- **Hassell, J. M., Begon, M., Ward, M. J., & Fèvre, E. M. (2016).** Urbanization and Disease Emergence: Dynamics at the Wildlife–Livestock–Human Interface. *Trends in Ecology & Evolution*. doi:10.1016/j.tree.2016.09.012
- **Cook, E. A., de Glanville, W. A., Thomas, L. F., Kariuki, S., Bronsvoort, B. M., & Fèvre, E. M. (2016).** Risk factors for leptospirosis seropositivity in slaughterhouse workers in western Kenya. *Occup Environ Med*. doi:10.1136/oemed-2016-103895
- **Cornelsen, L., Alarcon, P., Häsler, B., Amendah, D.D., Ferguson, E., Fèvre, E.M., Grace, D., Dominguez-Salas, P., and Rushton, J. (2016).** Cross-sectional study of drivers of animal-source food consumption in low-income urban areas of Nairobi, Kenya. *BMC Nutrition*, 2(1). doi: 10.1186/s40795-016-0109-z
- **Cook, E. A., de Glanville, W. A., Thomas, L. F., Kariuki, S., Bronsvoort, B. M., & Fèvre, E. M. (2017).** Working conditions and public health risks in slaughterhouses in western Kenya. *BMC Public Health*, 17(1), 14. doi:10.1186/s12889-016-3923-y
- **Makau, D. N., Gitau, G. K., Muchemi, G. K., Thomas, L. F., Cook, E. A., Wardrop, N. A., & de Glanville, W. A. (2017).** Environmental predictors of bovine *Eimeria* infection in western Kenya. *Trop Anim Health Prod*. doi:10.1007/s11250-016-1209-0
- <http://theconversation.com/how-an-urban-zoo-project-in-kenya-is-helping-unpack-the-spread-of-disease> <http://theconversation.com/how-an-urban-zoo-project-in-kenya-is-helping-unpack-the-spread-of-disease-67988>



End of 99 Household study Nyama Choma Party held at ILRI with over 40 people from diverse backgrounds in attendance...



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UPCOMING EVENTS:

- 9th and 10th February, 2017 at ILRI's Kapiti Plains Farm in Machakos, Kenya—Urban Zoo Annual Meeting.
- February 8, 2017 as from 9am to 5:30pm EAT at the Museum of Kenya-Louis Leakey Auditorium, Nairobi: Grazing for change-people, Pastures, progress and profit, conference: <https://www.eventbrite.com/e/grazing-for-change-tickets-30292786540>
- 25th to 29th April, 2017 at the Safari Park Hotel, Nairobi, Kenya—the joint Kenya Veterinary Association (KVA), the Commonwealth Veterinary Association (CVA) Golden Jubilee celebrations, and International conference and a World Veterinary Day: <http://www.kenyavetassociation.com/kva-annual-conferences/kva-joint-conference-2017/>
- 27-28 March 2017 at Aviemore – Inaugural meeting of the International Society for Economics and Social Sciences of Animal Health <http://www.isessah.com/>
- 28-31 March 2017 at Bujumbura – 6th East African Health and Scientific Conference. Theme: Preparedness for and Control of Disease Outbreaks, Epidemics, and Pandemics, the context of Climate Change, Globalization and Gaps in health Systems . <http://www.eac.int/6eahsc>
- 4-6 April 2017 at Kampala – 10th International Conference on Typhoid and Other Invasive Salmonellosis. <http://www.coalitionagainsttyphoid.org/call-for-abstracts-10th-international-conference-on-typhoid-and-other-invasive-salmonellosis/>
- 6-9 April 2017 at Washington DC – 8th Annual CHGH conference: Healthy People, Healthy Ecosystems. <http://www.cugh.org/events/2017-annual-cugh-global-health-conference>
- 17-19 May 2017 at Trieste – Impact of Environmental Change on Infectious Diseases <https://www.elsevier.com/events/conferences/impact-of-environmental-changes-on-infectious-diseases>
- 27-29 June 2017, Guildford – One Health: Zoonoses – Emerging Threats, Med-Vet-Net 2017; http://www.surrey.ac.uk/fhms/news/Events/5th_international_scientific_conference.htm
- 29 November – 1 December 2017 at Sitges (near Barcelona), Spain Epidemics⁶ - International Conference on Infectious Disease Dynamics