THE KENYA VETERINARY ASSOCIATION

...improving the livelihoods of Kenyans

52nd
ANNUAL SCIENTIFIC CONFERENCE, AGM & WORLD VETERINARY DAY CELEBRATION (WVD)

ANNUAL SCIENTIFIC CONFERENCE
GREEN HILLS HOTEL, NYERI COUNTY
25th - 27th April 2018

WVD LIVESTOCK EXHIBITION & FIELD DAY
DEDAN KIMATHI STADIUM, NYERI COUNTY
28th April 2018

Theme:
'One Health for Sustainable livelihoods'

HOST-KVA CENTRAL BRANCH

THE KENYA VETERINARY ASSOCIATION

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PROGRAMME & BOOK OF ABSTRACTS

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Word from the Chairman – Dr. Samuel Kahariri

The Kenya Veterinary Association (KVA) is honoured to spearhead the celebrations for the World Veterinary Day in the Country by bringing together all the stakeholders in the animal resource industry. This is the 52nd KVA annual scientific conference since inception in 1967. The theme of the conference is One Health for sustainable livelihoods. This conference provides a platform for the stakeholders and all the value chain players to share and learn the new innovations, technological advancements and new research findings that directly or indirectly facilitates the producers to increase productivity, minimize losses and maximize profits in the livestock related enterprises.

On behalf of the Kenya Veterinary Association leadership, I take this opportunity to welcome the delegates to this conference that has attracted a wide range of high quality papers whose findings are expected to be a key driver to the realization of the Big Four development agendas by the Kenyan government. I therefore call upon the delegates to see to it that the dissemination and implementation of the key findings and recommendations from this conference is achieved towards improving the livelihood of the Kenyan people.

The zeal and the dedication of the National Executive committee and the KVA central branch in organizing these events are acknowledged with immense gratitude. The team acknowledges and appreciates support from our partners and sponsors who played a great role in making this event a success. I therefore wish to appreciate all the stakeholders for their resolve to commercialize the livestock sector while guaranteeing the health of the Kenyan families.

God bless the animal resource industry!

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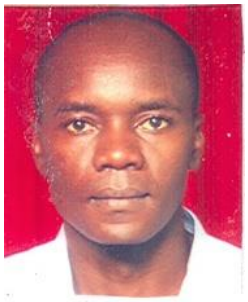
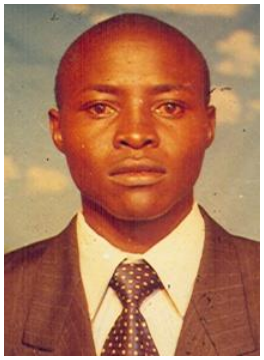
 **Dr. Joseph Odhiambo** **Hon. Treasurer**	 **Dr. Purity Kiunga** **Assnt. Treasurer**	 **Dr. Abraham Sangula** **Member**	 **Dr. Solomon Onyango** **Member**
 **Dr. Lilyan Mathai** **Member**	 **Dr. William Mwangi** **Member**	 **Dr. Benson Kibore** **Member**	

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2018 KVA Annual Scientific Conference & World Veterinary Day Program

Day	Wednesday	
Time/Date	**25-Apr-18**	
8:00	**Registration**	
8:30	**INTRODUCTION**	
	Session 1A: Food safety	**Session 1B: Companion Animal Health**
8:30	Investigating the potential for a syndromic surveillance system based on meat inspection records in western Kenya - **Laura C. Falzon**	Application of canine olfaction in forensics, conservation and medicine - **George E. Otianga**
9:00	Haematological parameters in camels slaughtered at Athi river camel slaughter house, Machakos county, Kenya - **Godana RB**	Spatial ecology of free-roaming owned dogs in western Kenya - **Patrick Muinde**
9:15	Implication of Antimicrobial Resistant bacteria and Brucella detected in milk from households in Isiolo and Marsabit Counties in Kenya - **Gabriel Aboge**	Understanding dogs' potential role in the transmission of Cystic echinococcosis in western Kenya - **Titus Mutwiri**
9:30	Food borne illness outbreak in Chala village following consumption of uninspected meat carcass, Taita-Taveta county, March, 2017 - **Jack Omolo**	Guidelines for Systematic and coordinated Mass Dog Vaccination Campaigns: Lessons Learnt in Pilot Counties, Kenya - **Augusta N. Kivunzya**
9:45	Emergence of Cysticercosis, a neglected meat-borne notifiable zoonosis in Thika sub-County of Kiambu County, Kenya - **Purity Nguhiu**	Investigation into ectoparasitide efficacy in pets- **Josphat Muturi**
10:00	DISCUSSION	DISCUSSION
10:15	**TEA BREAK**	
	SESSION 2	
10:45	**OPENING CEREMONY**	
11:15	One Health for Sustainable Livelihoods - **Andrew Thaiyah**	
11:45	Application of Socio Economics in disease control- **Tabitha Kimani**	
12:15	Opportunities in Implementing the Big Four Agenda in the Animal Resource Industry - **Christopher Wanga**	
12:45	DISCUSSION	
13:00	**LUNCH**	
	Session 3A: Zoonoses 1	**Session 3B: Animal Welfare**
14:00	Developing an integrated surveillance system for zoonoses in western Kenya - **Laura C. Falzon**	Dogs population management approaches - **Diana Onyango**
14:15	Identifying anthrax hotspots and the associated ecological factors in Kenya - **Gachohi Mwangi**	A cross-sectional study on the factors associated with calves with dirty leg scores kept in smallholder dairy farms in the Meru region of Kenya, and how this affects their welfare - **George Gitau**

14:30	Establishing a serum bank of confirmed cysticercosis positive and negative samples - **Maurice Karani**	Meat Chicken welfare: What are the current status in Kenyan farms - **Roselyn Wambugu**
14:45	Field investigation of human dog bites by suspected rabid dogs in Mathira east, 2017 - **David Mwangangi**	An overview of the impact of international trade in donkey skin on one health and sustainable development goals - **Solomon Onyango**
15:00	Evaluation of the Implementation of One Health in Kenya: a Case Study of the Zoonotic Disease Unit - **Kelvin Momanyi**	Training of animal health providers: the Kenya Veterinary Association, donkey welfare project experience-Kajiado, Kenya - **David Obiero**
15:15	Strengthening Capacity to Address Priority Zoonotic Diseases in Kenya - **Austine Bitek**	DISCUSSION
15:30	DISCUSSION	
15:45	**TEA BREAK**	
	Session 4: Livestock Marketing and Socio-economics	
16:00	Role of vets in Livestock Identification and Traceability System (LITS) - **Samuel Kahariri**	
16:15	Challenges in Marketing and market access by smallholder farmers **- KCB Foundation**	
16:30	Mapping Nairobi's dairy food system: an essential analysis for policy, industry and research - **Stella Kiambi**	
16:45	The effects of Climate Change on Livestock Health in Central Counties of Kenya- a study done using Participatory Epidemiological methods - **Waweru Kabaka**	
17:00	Pastoralists' perceptions and risk of Brucellosis in Kajiado County, Kenya - **Penina Mutua**	
17:15	Assessment of community behaviours towards anthrax disease in Transmara East, Narok County, southern Kenya, February 2018 - **Josephat Mbai**	
17:30	DISCUSSION	
17:45-18:30	**POSTER PRESENTATION**	
Day	**Thursday**	
Time/Date	**26-Apr-18**	
	Session 5A: Immunology and Vaccinology	**Session 5B: Wildlife, Equids and Camelids Diseases**
8:30	Determination of Peste des petit ruminante positivity and assessment of vaccination coverage for sheep and goats in North Horr Sub-County, Marsabit County, Kenya, 2016 - **Bernard Chege**	Capripox disease outbreak in endangered wildlife species in a wildlife park **- Stephen Chege**
8:45	A successful vaccine trial reveals an opportunity to control wildebeest-associated Malignant Catarrhal Fever in cattle - **Elizabeth Cook**	Molecular Epidemiology of African Horse Sickness in Kenya - **Otieno Owino Erick**
9:00	Protective Efficacy of different vaccination regimes against Newcastle Disease and Infectious Bronchitis Viruses in Broiler Chickens - **Walid Kelany**	Molecular Epidemiology of spotted fever group Rickettsioses at the wildlife-livestock interface in Maasai Mara and Laikipia Ecosystems, Kenya- **David Ndeereh**

9:15	Hope for improved livestock vaccines in Kenya using the technology of reverse vaccinology - **Wesonga H. O.**	Study of Middle East Respiratory Syndrome-corona virus in the Dromedary Population of Kenya - **Stella Kiambi**
9:30	The impact of ancestral dioxin exposure on Cyp1a1 promoter methylation - **Hesbon Amenya**	DISCUSSION
9:45	DISCUSSION	
10:00	**TEA BREAK**	
	Session 6: Policy and Governance	
10:30	Leadership and Ethical Governance issues in county governments - **Hygynus Asoka Itur**	
10:45	A review of policy domestication approaches for integrated planning the narrow agriculture sector - **Silvester David Ojigo**	
11:00	Assessment of the Veterinary Laboratory Capacity and Performance using FAO Laboratory Mapping Tool, Kenya 2017 - **Joshua Kimutai**	
11:15	An Evaluation of the subsidized Artificial Insemination Program implemented by the Government of Makueni County - **Daniel Ksee**	
11:30	Trends and level of clinical case exposure for training of undergraduate veterinary students in the university of Nairobi from 1980 to 2016- **James Nguhiu**	
11:45	Implications of Veterinary Medicine Directorate Regulations - **Nathan Songok**	
12:00	Understanding Codex- **Maritim Kimutai**	
12:15	Strides in the veterinary profession after the advent of the VSVP Act 2011- **Ragwa Indraph**	
12:45	DISCUSSION	
13:00	**LUNCH**	
2:00PM	**Annual General Meeting/Excursions**	
19:00	**AGM Dinner**	
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Time/Date	**27-Apr-18**	
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8:30	A Survey of Ectoparasite burden in households in seven selected counties in Kenya- **Abuom T**	Diamond V XPCTM: Balanced immunity for improved animal production and safe food – **Vincent Onsongo**
8:45	Multi-displinary student led engagement in community based intervention of one health challenges- a case study of Amboseli ecosystems Kenya- **Kirui G**	Use of Heifer-plus® to enhance Heifer calf pregnancies: a preliminary study in Kenya - **David Kihurani**
9:00	One health knowledge, attitude and practices among abattoir workers in Narok County - **Kipyegon A**	Management factors associated with weight gain in dairy calves/ heifers on smallholder dairy farms in Kenya - **Dennis Makau**
9:15	Prevalence of hydatidosis in cattle, sheep and goats slaughtered in an export slaughterhouse, Kenya - **Cameline Mwai**	Survival analysis of Red Poll and Red Poll crosses in the Lowland tropics - **Otieno Owino Erick**

9:30	Prevalence and Factors Associated with Antimicrobial Resistant Escherichia coli from Indigenous Poultry and Farmers in Kitui Rural Sub-County, Kenya 2017 - **Augusta N. Kivunzya**	Evaluation of milk yield performance of dairy cattle in smallholder farms in Meru, Kenya - **Muraya J.**
9:45	Sero - epidemiological survey for acute Q fever antibodies and risk factors among patients with febrile condition in two hospitals in Busia County - **Maurice Karani**	DISCUSSION
10:00	A near real-time livestock-wildlife syndromic surveillance system for early detection and response to biological threats in Kenya- **Kariuki Njenga**	
10:15	**TEA BREAK**	
	Session 8A: Food Animal Health 2	**Session 8B: Trans-boundary animal diseases**
10:45	Occurrence of bovine mastitis in urban and peri-urban areas of Naivasha - **Peter Ndirangu**	Circulating foot-and-mouth disease virus serotypes detected from cattle populations in eight geographical areas of Tanzania - **Evaline James Mfuru**
11:00	Pathological and molecular characterization of wooden breast disease: An emerging myopathy in commercial broiler chickens - **Michael Babak**	Sero-positivity of Foot and Mouth Disease in Cattle, Marsabit County, Kenya November, 2016 - **Boku Bodha**
11:15	Sero-prevalence and risk factors of bovine Neospora and Bovine Viral Diarrhea Virus infections in dairy cattle in Meru County, Kenya - **Muraya J.**	Characterization of foot and mouth disease distribution in Kenya in the period 2016 – 2017 - **Ibrahim Kariuki**
11:30	Microcardia associated with traumatic Reticulopericarditis (TRP) in an adult female Ayrshire cow: A case report- **Essau Serem**	Epidemiological Analysis of Passive Surveillance Data on Foot and Mouth Disease Occurrence in Nakuru County, Kenya - **Dickson Machira**
11:45	Effects of river pollution in urban informal settlements on the Boar Testis - **Ambrose Kipyegon**	Trends in Foot and Mouth Disease outbreaks and associated impact on control strategies in Kenya - **Benson Kibore**
12:00	Sero-prevalence of bovine leukosis infection in contrasting farming systems in Kenya - **George Gitau**	Insights into the epidemiology of Foot-and-Mouth Disease virus in rangelands shared by African buffalo and cattle in Laikipia County, Kenya- **Francis Gakuya**
12:15	Integrated approaches to clinical and herd health management in food-producing animals: A review- **J. K. Muthee**	Market performance and the risk of spread of foot and mouth disease through cattle marketing activities in Western Kenya - **Richard Onduso**
12:30	Current trends in mycotoxins control - masked and emerging mycotoxins - **Josephat Muturi**	Characterization of reported Lumpy Skin Disease cases in Kenya, in bovine, 2015-2017 - **Daniel Ong'are**
12:45	DISCUSSION	DISCUSSION
13:00	**LUNCH**	
	Session 9A: AMR & Drug related	**Session 9B: Zoonoses 2**

	issues	
14:00	Good Distribution Practices (GDP) for Veterinary Medicines and Implications for non compliance - **Maurice Ogutu**	Occurrence of Animal Bites and Factors Associated with Delayed Initiation and Non-adherence to Post-exposure Prophylaxis for Rabies, Uasin Gishu County, 2017 - **Khadija Chepkorir**
14:15	Antimicrobial susceptibility patterns of *Staphylococcus aureus* in milk samples submitted at regional veterinary investigation laboratory Karatina, 2015 – 2017 - **David Mwangangi**	Suspected human cutaneous anthrax in Thika – Kenya - **Erick Orimbo**
14:30	One health coordination platforms: Need to think beyond zoonoses to accommodate antimicrobial resistance and other relevant issues - **Stella Kiambi**	One Health focus within the Kenya Field Epidemiology and Laboratory Training Program - **Mark Obonyo**
14:45	Overview of Governmental support across Africa towards the development and growth of Herbal Medicine - **Dominic Ochwang'i**	Assessment of Rabies situation in Five Informal Settlements of Nairobi, 2017 - **Martin Nyamweya**
15:00	Pathogens isolated in mastitic milk and their antimicrobial resistance at the RVIL – Kericho, 2013 – 2016 - **Hector Kusiru**	Epidemiology and Surveillance of Human Animal-bite Injuries and Rabies Post-Exposure Prophylaxis, in Selected Counties in Kenya - **Jeremiah N. Ngugi**
15:15	DISCUSSION	DISCUSSION
15:30	**TEA BREAK**	
	Session 10: Aquaculture and Apiary	
15:45	Comparative assessment of hatching rates of African Catfish (Clarias gariepinus) eggs using Nile cabbage and Kaka Bans substrates - **Felix Kibegwa**	
16:00	Overview of farmed fish parasites in central Kenya with emphasis on importance and control - **Waruiru R.M.**	
16:15	Preliminary findings of common bacterial pathogens affecting farmed fish in Kirinyaga County, Kenya - **Daniel Wanja**	
16:30	Heavy neascus species infestation of farmed *Oreochromis niloticus* in Kirinyaga County, Kenya - **Janet Mwadime**	
16:45	The pathogens affecting the health of the domesticated honey bees, *Apis mellifera* in Kenya - **Irene Onyango**	
17:00	DISCUSSION	
	Closing Ceremony	
Day	**Saturday**	
Time/Date	**28-Apr-18**	
8:00	**World Veterinary Day**	
8:30	**FIELD DAY & LIVESTOCK EXHIBITION**	
13:00	**LUNCH**	
15:45	**ENTERTAINMENT & SPEECHES**	
16:00	**DEPARTURE**	

Investigating the potential for a syndromic surveillance system based on meat inspection records in western Kenya

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[4]Kestrel Technology Group, Texas, USA
[5]Veterinary Public Health Institute, Liebefeld, Switzerland

Syndromic surveillance relies on health-related indicators, such as slaughterhouse condemnation data, as a proxy for the presence of disease within a population. This study is investigating the potential for a syndromic surveillance system based on meat inspection data in western Kenya.
Two ruminant slaughterhouses in Bungoma County, western Kenya, were purposively selected based on the trust relationship established with the meat inspector at each site. Meetings were held with the meat inspectors to discuss which data they routinely collect or would like to investigate further. This information was used to develop a digital form which captures both photos and information on the slaughtered animal, any organ condemned and reason for the condemnation, and the cost of discards. The form was placed onto Android mobile devices; each meat inspector received a device and was tasked with submitting a form for every animal slaughtered at their facility. These data reports are transferred directly into an electronic database which can be viewed in real-time.

Since the start of the study in mid-March 2017, the two meat inspectors have submitted 7386 reports, with an average of 24 reports/day. These reports concerned 3031, 2405 and 1950 cows, goats and sheep, respectively; 21% of the slaughtered animals had a condemnation reported. Overall, the most frequently discarded organs in cows, sheep and goats were livers (n=891) and lungs (n=317);fasciolosis (n=400), cirrhosis (n=216),hydatidosis (n=186) and pneumonia (n=61) were the most common reasons for condemnation. Each discarded liver and lung cost the animal owner on average Kshs758.00 and 451.00, respectively. Additionally, 356 foetuses were discarded, suggesting important reproductive losses. Future investigations will include time-series analysis and fitting of simple detection algorithms.

These preliminary findings suggest that the system has been well received by the meat inspectors, while highlighting the wealth of real-time information that can be used for early disease warning purposes.

Keywords: slaughterhouses; condemnation data; early warning system; mobile technology; real-time data collection

Haematological parameters in camels slaughtered at Athi river camel slaughter house, Machakos county, Kenya

Godana, R.B., *Kirui, G., Kipyegon A.N., Abuom, T.O., Thaiyah, A.G., Gakuya, D.W., Ifedha N.S. and Kamau, J.P.

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Although camels are most important source of livelihood and play an important role in survival of most communities in Arid and Semi-Arid Lands, their health and challenges are neglected by many researchers. Camels are generally known to be hardy, however they are affected by many diseases which alter their hematological parameters such as Packed Cell Volume (PCV). The increasing adoption of camel meat and other camel products increases the health and product quality risks which

some haematological parameters can assist in pointing out. This study was conducted with the objective of documenting the haematological parameters in camels presented for slaughter at Athi River Camel Slaughter House (ARCSH), Kenya. Information relating to the source of the camels was collected as well as health parameters and blood sampled for haematological tests.Sixty-eight camels (31 females, 37males) presented for slaughter at ARCSHwere assessed over a period of one week in November, 2015. The camels presented for slaughter originated form Marsabit County (44%), Moyale County (37%) Isiolo(10%)and Garissa (9%) Counties. On average about fifteen camels were slaughtered daily at ARCSH. The mean age of camels presented for slaughter was 8.1(SD$\pm$2.5) years, with a range of 5 -15 years. All camels presented for slaughter had normal hematological values. The study concludes that Camels presented for slaughter were in good health since they had normal hematological values with no indications of infections on hematological exam.

Keywords: haematological parameters, camels, slaughter, haemoparasites

Implication of antimicrobial resistant bacteria and *Brucella* detected in milk from households in Isiolo and Marsabit counties in Kenya

Gabriel Aboge[1], Isaac Omwenga[1,3], Catherine Ngaywa[2,3]Martin Wainaina[3], EricO. Mitema[1], Bernard Bett[3]

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Milk is an important source of nutritive food in Northern Kenya. However, information on the risks of consuming milk contaminated with antimicrobial resistant *Staphylococcus aureus* (S. aureus) and *Escherichia coli* (*E. coli*) as well as Brucella is generally lacking. The objective of this research was to determine the presence of antimicrobial resistant-*S. aureus* and *E. coli* as well as *Brucella* species in cattle and camel milk intended for human consumption in Isiolo and Marsabit. The presence of *S. aureus* and *E. coli* was determined by using culture, biochemical tests, polymerase chain reaction (PCR) and DNA sequencing. The presence of *Brucella* species was determined by Enzyme linked Immunoassay (ELISA) and quantitative-PCR. Antimicrobial susceptibility testing was done by Disk diffusion method using Mueller Hinton Agar using Clinical Laboratory and Standards Institute breakpoints (2014). The sequenced PCR products confirmed *S. aureus with* 28 isolates resistant to Oxacillin of which 17 were multi drug resistant to tetracycline, clindamycin and kanamycin. *E.coli* isolates detected in some milk samples were multidrug resistant to ampicillin, amoxicillin, tetracycline, and cefotaxime. Co-occurrence of the resistant- bacteria and *Brucella* in milk was confirmed. The findings confirm co-occurrence of antimicrobial resistant-*S. aureus* and *E. coli* as well as *Brucella* species in milk intended for human consumption in Isiolo and Marsabit.

Keywords: Milk, Antimicrobial resistance, *Brucella spp*, Isiolo, Marsabit

Food borne illness outbreak in Chala village following consumption of uninspected meat carcass, Taita-Taveta County, March, 2017

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Food borne illnesses are caused by ingestion of contaminated food or water and manifest as acute gastroenteritis. Consumption of uninspected meat or dead carcass is a risk factor. A team from field epidemiology and laboratory training program (FELTP) investigated an outbreak of suspected food borne illness among villagers in Chala, TaitaTaveta to characterize the outbreak and identify a possible cause.

A retrospective review of hospital records was done to identify cases. Additional community cases were identified using snow balling technique. A case was an acute illness, with severe abdominal pain and loose stool ≥3 times within 24 hours with or without vomiting occurring in person of any age in Chala Village, Taveta Sub Countyin March, 2017.We sought exposure information such as history of consumption, skinning, butchering, and cooking of the dead cow. Structured standardized questionnaires were administered to all exposed persons. Data was collected and analyzed using Epi Info.

Among 86 persons who were exposed to the dead cow, 68 (79%) became ill. The median age of the cases was 28 years, IQR: 33 years. The median incubation period was 38 hours (range, 13 -76 hours). Among the cases, 64 (96%) sought medical care and 10 (16%) were hospitalized. Diarrhea was reported in 49 (72.1%) of the cases. Other common symptoms were abdominal pain 45 (67%), loss of appetite 50 (75%) and headache 33(50%) with one death occurring in a 9 year old boy, giving a case fatality rate of 1.5%.

The likely cause of the outbreak was *Clostridium perfringens*withentero- toxigenic *E. coli* as a differential cause. The county veterinary department should conduct education and awareness creation on the importance of consuming only inspected meat.

Key Words:*Clostridium perfringens*, foodborne, Bovine

Emergence of Cysticercosis, a neglected meat-borne notifiable zoonosis in Thika sub county of Kiambu county, Kenya

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The tapeworm *Taenia solium*, transmitted between humans and pigs, affects millions of people in sub-Saharan Africa. Epilepsy and headache are common symptoms leading to human suffering, stigmatization, and death. In addition, infected pigs lead to considerable economic losses due to down grading or total condemnation of the carcass in Kenya as per Meat Control Act. Thika has been reported as the highest consumer of pork among Kenyan urban areas and a comprehensive survey of cysticercosis in the area had not been previously carried out hence prevalence not established. A study was done from May 2016 to June 2017 with the purpose to investigate the prevalence and factors associated with taeniosis and porcine cysticercosis in Thika Sub County. The specific objectives were to determine the prevalence and factors associated with *Taenia solium* taeniosis/ cysticercosis, prevalence of porcine cysticercosis in pig farms and seroprevalence of porcine cysticercosis in pigs slaughtered in abattoirs in Thika. The community survey was conducted in three Wards, where 384 participants were recruited randomly, one participant per household, data on perception, knowledge and practices that may lead to transmission of taeniasis was collected using a structured questionnaire, each study participant provided a single stool sample for parasitological evaluation for *T. solium* eggs for prevalence. Thika Level 5 Hospital records for the period 2005 to 2015 were reviewed for cases of Cysticercosis. Twenty pork eateries in Thika sub- county were evaluated using observation check list on hygiene, handling and preparation of pork, 80 pig meat vendors, four per pork eatery provided information on knowledge on taenisis and factors that may lead to its transmission and 200 pig meat consumers found the eateries gave same information including preferred method for pork preparation using semi structured questionnaire. Pig production systems in three Wards in Thika sub County namely Gatuanya, Kamenu and Township and Kimorori Ward in Murang'a South Sub County where 81 pig farms were visited and lingual palpation was done in 273 randomly selected pigs to examine for cysticerci. Blood for serology was collected from every 5th pig presented for slaughter in the two pig

abattoirs, a total of 182 serum samples were evaluated using Cysticercosis Ag ELISA invitro diagnostic kit (apDia, Belgium) to detect circulating antigens in the serum as an indicator for viable cysts. None of the pigs slaughtered and inspected during the survey were reported positive although on there was positive response on ELISA. Taeniosis was present among the community members with prevalence at 6.3 % while thirteen cases of cysticercosis had been recorded in Thika Level 5 Hospital. The level of awareness among pig consumers and vendors on taeniosis/ cysticercosis was found to be low with fried pork being the most preferred method for pork preparation. Prevalence of porcine cysticercosis by lingual palpation was reported at 1.81% among the farms surveyed and seroprevalence using antigen ELISA was1.83%. In conclusion, these results are significant in that they report on presence of human and porcine cysticercosis for the first time and therefore the need to control this important zoonosis in the area.

Key words:Taenia solium, abattoir surveillance, pork tapeworm, cysticercosis

Application of canine olfaction in forensics, conservation and medicine

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Domestic dogs (*Canis lupus familiaris*) have long been recognized for their exceptional and superior sense of smell amongst domestic animals. Olfaction, a ubiquitous modality of chordates, is a complex function that involves both primitive and higher processing of the brain, and is mediated by olfactory cells of the nasal cavity. Many species, including domestic canines, are macrosmatic, possessing very strong sense of smell; unlike humans who are microsmatic with low olfacotry acuity. The canine nose has over 200 million olfactory cells (which is 40-50 times the number found in human nose) and two-thirds of a dog's brain is purely devoted to olfaction. While the process of olfaction is not entirely clear the basic mechanisms involve the detection of odorant compounds by olfactory receptor cells, and subsequent signal transmission to the brain by the olfactory nerves. Olfaction is largely based upon binding of odorants to odorant receptors, vomeronasal receptors and trace amine-associated receptors and the ratio of these receptors is species-specific. In this presentation, we will review the anatomical, physiological and genetic differences that have allowed dogs to be more effective in processing chemosensory information from their environment, as well as how humans have harnessed this prowess for use in various application of forensics, conservation and medicine.

Spatial ecology of free-roaming owned dogs in western Kenya

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Dogs' ecology, and their interaction with abattoirs, influences their role in dog-transmitted zoonoses. The objective of this study was to investigate dog movement between their homesteads and local abattoirs, to better understand how this may then impact zoonotic disease spread in western Kenya.

Eight ruminant abattoirs in Busia County were purposively selected, and 10 dog-keeping homesteads within 1.1 km of each abattoir were recruited. In each homestead, one owned, free-roaming dog was identified and a Global Positioning System logger fixed around its neck. Loggers were programmed to capture the dog's position every minute for five days. Questionnaire data were collected from each dog owner, and from one meat inspector or manager in each abattoir. The core and extended home ranges (HR) for each dog were estimated using the biased random bridges method.

All eight abattoirs operated daily, and the average daily kill ranged between 2 to 15 animals. After cleaning, spatial data were available for 73 of the 81 dogs sampled. The daily distance traveled by each dog ranged between 2.0 to 24.5 km. Both the core and extended HRs varied between dogs ($0.4^{10}*^{-5}$ to 2.38 ha and 1.21 ha to 97.39 ha, respectively), and plots revealed an overlap of most HRs with both the abattoir area, and the HRs of other dogs. The latter is congruent with the fact that the majority of owners (90.8%) reported seeing other dogs in their homesteads.

This study demonstrates that the movement of free-roaming owned dogs in western Kenya covers a considerable area, creating an opportunity to interact with abattoirs, as well as other dogs, livestock, and humans. Further investigation of dog and abattoir-level risk factors will unravel the heterogeneity of dog roaming behaviour, and inform management practices to reduce the spread of zoonotic diseases.

Key words: dog-borne zoonoses; dog movement patterns; abattoirs; homesteads; GPS data-loggers

Understanding dogs' potential role in the transmission of cystic Echinococcosis in western Kenya

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Introduction: Cystic Echinococcosis is endemic in humans and livestock in many pastoral communities in Kenya. However, due to livestock trade, the spread of CE to non-endemic areas such as western Kenya is possible particularly if infected offal are not properly disposed of during slaughter hence picked up by free roaming dogs. This study aimed at establishing the role dogs may play in transmission of *Echinococcus granulosus sensulato*.

Methodology: We selected eight ruminant slaughterhouses in Busia County, and around each slaughterhouse we selected ten homesteads owning free-roaming dogs. We administered a questionnaire on dog management practices to the homestead owner, and collected a faecal sample directly from the dog's rectum. The faecal samples were examined microscopically for the presence of taeniid eggs and other canine intestinal parasites. Additionally, faecal suspension in PBS and 0.3% Tween 20 were aliquoted for *Echinococcus* spp. copro-antigen ELISA detection.

Results: Taeniid eggs were presumptively identified in faeces from 5 of the 82 dogs, but species identification willbe conducted by CoproPCR, restriction fragment length polymorphism or partial sequencing. Additionally, the Copro-ELISA process will help detect infection in dogs where no eggs were isolated. Microscopicexamination revealed that 43/82 (52.4%) dogs were infected with hookworms,furthermore, 7/82 (0.09%), 2/82 (0.02%), and 1/82 (0.01%) of the dogs were infected with ascarids,*Spirometra*, and *Trichuris* spp. respectively. Analysis of questionnaire data will reveal management practices associated with these parasitic infections.

Conclusion: These preliminary results indicate a relatively high carriage of zoonotic parasites by free-roaming domestic dogs in Busia County, which pose potential risk to human and livestock populations. In this particular study, at the larval stage, the identified hookworm may cause cutaneous larval migrans in humans. This study will be extended to Bungoma and Kakamega Counties, where we intend to conduct surveillance for canine echinococcosis and human hydatidosis.

Keywords: Taeniid eggs, hookworms, surveillance, hydatidosis, zoonotic parasites, CoproELISA, CoproPCR

Guidelines for systematic and coordinated mass dog vaccination campaigns: lessons learnt in pilot counties, Kenya

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Introduction: In 2014, Kenya developed a rabies elimination strategy in line with the global goal of eliminating dog-mediated human rabies by 2030. The elimination framework is based on four major pillars with mass dog vaccination (MDV) of 70% of dogs being the main strategy. The main challenge in implementing the strategy has been lack of standardised guidelines to regulate and coordinate implementation of dog vaccinations across different regions. Although disease control is a devolved function, mass dog vaccination campaigns need coordination. To guide implementation of the strategy component of mass dog vaccination, the Zoonotic Disease Unit (ZDU) with support from partners has developed MDV guidelines. We hereby describe the guideline's key outputs.

Methods: A series of multisectorial subject matter expert meetings were held for the last two years to develop drafts and review the guidelines.

Outputs: The MDV guideline describes the framework of a vaccination campaign designed to achieve 70% coverage by describing the main components of a MDV; estimation of dog population in an area, resource mobilization, publicity and community mobilization, vaccination and post-vaccination surveys to estimate vaccination coverage. These guidelines therefore are designed to provide a systematic way to conduct successful mass dog vaccination in Kenya and if implemented they will contribute to coordinated and sustained efforts towards rabies elimination by 2030.

Key words: Vaccinations, Guidelines, Dogs, Rabies

Investigation into ectoparasitides efficacy in pets (dogs)

Josphat Muturi

Background: Fluralaner, a new molecular entity of the isoxazoline class, has potent insecticidal and acaricidal activity and can be safely administered orally to dogs

Methods: A randomized, investigator-blinded, multi-centered field study compared the flea- and tick-control efficacy for dogs over a 12-week period with either a single oral dose of fluralaner formulated as a chewable tablet or with three sequential topical fipronil treatments. Individual dogs were the experimental unit for ticks and households were the experimental unit for fleas. A total of 108 tick-infested dogs were treated with fluralaner and 54 tick-infested dogs were treated with fipronil. Dogs in 115 flea-infested households received fluralaner and dogs in 61 flea-infested households received fipronil. Flea and tick counts were conducted on all dogs at weeks 2, 4, 8, and 12 following initial treatment and efficacy was calculated as the mean percent reduction in tick or flea count at each time point compared with the mean pretreatment initiation count for each treatment group. Additionally, the percentages of tick-free and flea-free households were determined.

Results: At weeks 2, 4, 8, and 12, fluralaner flea-control efficacy in treated households was 99.2%, 99.8%, 99.8%, and 99.9% respectively, while fipronil efficacy was 94.1%, 93.0%, 96.0%, and 97.3%, respectively. Fluralanertick-control efficacy on treated dogs at weeks 2, 4, 8, and 12 was 99.9%,

99.9%, 99.7%, and 100%, respectively, and fipronil tick efficacy was 97.6%, 93.8%, 100%, and 100%, respectively. Of dogs showing clinical flea allergy dermatitis (FAD) signs at the study start, 85.7% in the fluralaner-treated group and 55.6% in the fipronil treated group were evaluated at each time point as showing no clinical signs of FAD until study completion.

Conclusions: Fluralaner administered once orally to dogs in a chewable tablet was highly effective for 12 weeks against fleas and ticks on privately-owned dogs and was significantly non-inferior (ticks) and superior (fleas) in comparison with topical fipronil administered 3 times sequentially.

Developing an integrated surveillance system for zoonoses in western Kenya

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Surveillance of diseases in Kenya is currently carried out by both human and animal health sectors. However, a recent evaluation highlighted the lack of integration between these sectors, leading to disease under-reporting and inefficiencies. This project aims to develop an integrated and cost-effective surveillance system for zoonotic diseases in western Kenya.

Interviews were carried out with government veterinarians and public health officers, and this was followed by field visits to identify sentinel sites and liaise with relevant stakeholders. A sampling strategy was developed whereby 12 livestock markets and neighbouring slaughterhouses, and 9 hospitals, are visited every 4 weeks for 24 cycles. At each site, sampling of animals or patients includes a clinical examination and collection of blood, faeces and nasal swabs; in animals, tissue samples, mesenteric lymph nodes, hydatid cysts, flukes and ticks are also collected. Samples are then tested for various zoonoses and characterized for speciation; diagnostic tests employed include microscopy, bacterial cultures,ELISA and PCR.

We have completed 6 of the 24 cycles, and have sampled 700 animals (433 cows, 127goats,82 sheep, and 58 pigs) and 172 patients. Additionally, we have collected ticks, liver flukes and hydatid cysts from 168, 38 and 8 cows, respectively. Each field visit lasts approximately 2, 4 and 4.75 hours at the livestock market, slaughterhouse and hospital, respectively. Challenges include frequent declines by livestock traders at some markets, quick slaughter process and/or poorly engaged meat inspectors at some slaughterhouses, and nurse strikes and frequent staff turnover in hospitals. Preliminary results indicate a campylobacteriosis frequency of 11.9%, 11.8%, 3.7%, 3.0% and 1.6% in sheep, pigs, cows, goats and patients, respectively.

These preliminary results indicate the presence of circulating zoonoses, while our experience so far has highlighted the importance of engaging with local stakeholders and providing timely feedback to ensure ongoing compliance.

Identifying anthrax hotspots and the associated ecological factors in Kenya

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Introduction: Anthrax is a high-impact neglected zoonosis historically thought to be associated with certain ecologies. The disease burdens cut across significant morbidity and mortality in humans, livestock, and wildlife. The overall goal of this project is to identify anthrax hotspots and associated ecological factors predicting infection and exposure risk in Kenya to betterinformsurveillance and targeted control measures.

Methods: Data will be sourced from three broad sources: (1) a retrospective review of animal (livestock and wildlife) and human anthrax records, (2) serosurvey in dogs and humans in all geographical zones of the country, (3) on-going anthrax outbreak site characterization. These data will be used to develop an ecological niche model to identify high-risk areas and temporal and environmental signals associated with emergence and persistence of the disease.

Results: In a preliminary survey, known anthrax hotspots in Isiolo, Marsabit and Wajir Counties Kenya were georeferenced, and the spatial points obtained used to develop a regional-based ecological niche model. Predictors used in the analysis included bioclimatic data (version 2) obtained from the WorldClim – Global Climate Data (http://www.worldclim.org/bioclim), soils and altitude. The lowest Receiver Operating Characteristic (ROC) was estimated to be 0.68, indicating that the models fitted the data well. Significant factors identified by the models for anthrax distribution in the area included high mean diurnal range in temperature and high annual precipitation.

Conclusions and Future Work: Records review is complete and anthrax sero survey is underway. This project offers a great opportunity in acquiring historically understudied epidemiological and ecological data and knowledge to be applied in research and in turn used by the policy makers in designing risk-based surveillance and control activities besides advancing anthrax research. Closer collaboration between various partners and other stakeholders, e.g. intensified reporting of anthrax outbreaks when they occur will expand the quantity and quality of data.

Establishing a serum bank of confirmed Cysticercosis positive and negative samples

Maurice Karani

Background and introduction: Taenia solium is a cestode parasite transmitted between humans acting as definitive hosts and pigs as intermediate hosts. The medical significance of the parasite arises not from it causing taeniasis but because humans may become infected with the larval or metacestode life cycle stage, in which case it commonly encysts in the brain and spinal cord, causing neuro cysticercosis. Several serological tests have been developed which detect circulating T. solium cyst antigens in humans and animals. Most of the existing evaluating test have a poor specificity hence limiting their diagnostic capacity. This project aims to collect a bank of confirmed cysticercosis positive and negative samples from pigs that will be used for future diagnostic test validation.

Methods: We propose to recruit twelve slaughterhouses from two counties (Kakamega and Busia) with the help of County Directors of Veterinary Services. We will purchase, at market rate, 10 pigs from 12 different slaughterhouses. Sampling will be conducted over 5 months and no more than two pigs will be purchased from one slaughterhouse per month. This will avoid destabilizing the pork market as a result of our research activities. The selected pigs will undergo the normal slaughtering procedure at the slaughterhouse, enhanced by the study team to ensure appropriate ethical standards are upheld.

Ante mortem lingual palpation will be carried out, while blood collection will be performed post mortem. The age, sex and origin of the animal will be recorded, and a very detailed carcass dissection (including major organs) performed, with tissue containing cysts being sampled for further molecular diagnosis.

Expected results: A bank with confirmed cysticercosis positive and negative samples will be established. The results will be in open access and hope this will expedient validation of better diagnostics kits to aid quicker and more accurate diagnosis of the disease.

Key words: cysticercosis, T.solium, Diagnostic test

Field investigation of human dog bites by suspected rabid dogs in Mathira East, 2017

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In low and middle-income countries, dogs account for 76–94% of animal bite injuries with consequences such as rabies disease, which is fatal and of public health significance. World Health Organization (WHO, 2013) reports over 55,000 human deaths due to rabies annually, most being due to lack of post-exposure treatment and appropriate access to health care. In August, 2017, Regional Veterinary Investigation Laboratory, Karatina, received 4 samples from 2 dogs, a cat and a cow which were positive for Rabies. We carried out a field investigation in Mathira East with the following objectives: to do an active case search and contact tracing of dog bite victims, to describe characteristics of the bites and post bite management, to determine knowledge, attitudes and practices among victims, family and neighbours using a data collection tool for bite victims, key informant interviews and questionnaires. There were 6 victims of dog bites with most bites being in the limbs. Half of the affected victims were farmers and all had sought medical care and were on rabies post-exposure treatment. Out of 34 people interviewed, majority (over 70%) were farmers and most (over 70%) were aware about rabies, its clinical signs in animals and prevention in dogs. All were aware that most dog bite victims should seek immediate medical care but few (26%) were aware of cleaning bite wounds as a way of preventing virus spread. The local communities should be aware of strange dogs with abnormal behaviour and need to clean bite wounds and vaccinate pets annually to prevent virus spread.

Key words: Rabies, knowledge, animal bite, prevention and control

Evaluation of the implementation of one health in Kenya: a case study of the zoonotic disease unit

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Background: Kenya became one of the first country in Africa to institutionalize One Health and operationalized it on 1st March 2012 as a cross-sectoral collaboration. Globally, several countries have followed suite in institutionalizing One Health. Several One Health initiatives have been implemented, such as the establishment of cross-sectoral coordination, communication and data sharing mechanisms, but no standardized methodology exists for quantitative evaluation of One Health activities. Therefore, the Network for Evaluation of One Health (NEOH) aims to enable future quantitative evaluations of One Health activities.

Objectives: This study aimed to evaluate the effectiveness and impact on stakeholders of this cross-sectoral One Health approach in Kenya, the Zoonotic Disease Unit.

Methods: This was a process evaluation using the Network for Evaluation of One Health standardized One Health evaluation framework. Data collection was by 27 face-to-face key informant individual interviews using the Bristol Online Survey and focus group discussions. Qualitative data was thematically analyzed using NVivo Pro while quantitative data was through SPSS v23 and the One Health Index.

Results: ZDU attained a One Health Index of 0.73269 with a score of 0.70 in One Health planning, 0.37 in One Health learning, 0.50 in One Heath working and 0.50 in One Health thinking. Evidently, ZDU has a lot to gain if it took advantage and invested in a One Health infrastructure (sharing) and continued to strengthen its operational arm (transdisciplinarity).

Conclusion: The critical application of the NEOH One Health standardized One Health evaluation framework will boost efforts of highlighting and understanding the added value of One Health approaches in not only Kenya but also other developing nations. We further recommend it for a further economic and impact evaluation to complement this process evaluation.

Key words:Cross-sectoral; Evaluation; Framework; Kenya; Metrics; One Health; ZDU

Strengthening capacity to address priority zoonotic diseases in Kenya

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The launch of the Global Health Security Agenda (GHSA) in February 2014 capped over a decade of global efforts to develop new approaches to emerging and re-emerging infectious diseases—part of the growing recognition that disease events, whether natural, accidental, or intentional, threaten not just public health, but national, regional, and global security interests. From 2016Under the Emerging Pandemic Threats (EPT)-2 Programme of USAID, FAO has been supporting implementation of the GHSA in the country using a One Health approach which provides concrete action plans for 1) prevention of avoidable epidemics, 2) early detection of threats, and 3) rapid and effective response against infectious disease outbreaks including priority zoonotic diseases in Kenya. The Action Packages of the GHSA are designed to accelerate progress toward these goals by facilitating collaboration toward specific GHSA objectives and targets and/or milestones. Key achievements to date include: enhanced capacity of the veterinary services directorate to prepare, detect and respond to priority zoonotic diseases (Anthrax, Brucellosis, Rift Valley Fever, Highly Pathogenic Avian Influenza and Rabies) through strengthened laboratory detection capacity of the Central Veterinary Laboratory, Regional Veterinary Investigation Laboratories and Veterinary Research Institute Laboratory; enhanced epidemio-surveillance capacity for the priority zoonotic diseases and improved animal health workforce with prerequisite skills, competencies and tools necessary to address priority zoonotic diseases through trainings which have been conducted to national and sub-national animal health workforce.

Key words: Global Health Security Agenda, Action Packages

Dogs population management approaches

Dr. Diana Onyango

Kenya has an estimated dog population of 6 million dogs of which over 20% are stray or roaming dogs. Stray dogs can be classified as owned dogs allowed to roam freely or unowned dogs as result of being abandoned, lost or unwanted breeding. The presence of stray dogs poses public health risks to communities of contracting zoonotic diseases such as rabies. Other risks are dog bites and general fear spread in the community due to their aggressive behaviour, transmission of diseases to other animals, noise nuisance and environmental fouling. There are options that are used to control the population of stray dogs while at the same time reducing the risks of zoonosis transmission in human populations. While the reduction in stray dogs' numbers is the desired outcome, the welfare of the animals should be considered during such activities. Various international organizations such as World Organization

for Animal Health (OIE), the Food and Agriculture Organization of the United Nations (FAO) and others under the umbrella of the International Companion Animal Management Coalition (ICAM Coalition) have developed dog population management guidelines that consider these issues as well animal welfare, which can be adapted to the local context. The basis of these approaches is assessment of local dog population and review of legislation and policies which inform the approach used that include education programmes, identification and traceability, reproduction control and euthanasia. Effective and comprehensive dog population management programmes need a centralized coordination by local government authorities to collaborate with NGOs and other animal welfare organizations.

Keywords: animal welfare, strays, roaming dogs, dog population

A cross-sectional study on the factors associated with calves with dirty leg scores kept in smallholder dairy farms in the Meru region of Kenya, and how this affects their welfare

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Background: The welfare and health of calves is affected by housing management practices. Objectives: a) to determine aspects of the welfare of dairy calves in smallholder dairy farms in Meru County; and b) to determine the factors associated with dirty legs in calves reared in Meru County, as an indicator of their welfare.

Methodology: A survey was carried out in Meru County, Kenya, in 2017, on 52 calves that were ≤ 1 year old in 38 dairy farms whose mean lactating cow-herd size was 1.71±0.7 and average milk production of 6.7±3.1 liters/day. Calf biodata and health status were assessed through physical exams, while leg dirtiness was evaluated using a 5-point scoring system ranging from 1 (very clean) to 5 (very dirty). Pen floor surface area was measured, and pen characteristics were scored, such as floor hardness and dirtiness through standard knee impact and knee wetness tests. A questionnaire was administered to the farmers face-to-face to gather information regarding calf housing management practices in the farm. Univariable and multivariable logistic models were used to determine factors associated ($p<0.05$) with calves categorized with dirty legs (dirtiness score >2.5), controlling for confounding of other variables in the model.

Results: The 52 calves had a mean body weight of 85.2 ± 32.8 kg and average daily weight gain (ADG) of 0.68 ± 0.698 kg, and 71% had ≥ 2.5 body condition score. The mean leg dirtiness score was 2.3±1.1. Thirty-five percent (18/52) of all the calves observed were categorized as dirty, with a leg dirtiness score more than 2.5. A total of 75% (39/52) of the calves were kept in pens and the rest (13/52) were reared outdoors day and night, with access to shelter during rains. The calves kept in pens had a mean space allowance of 2.52 ± 1.56 m^2. For the 39 calves in pens, 16 of them (41%) were categorized as dirty, and 23.1% and 33.3% were in pens that had failed knee impact and knee wetness tests, respectively. In univariable logistic regression analyses of the 52 calves, housing calves indoors increased the odds of calves being dirty by 6.3 times (P=0.045). In the final multivariable logistic regression model of 39 calves in pens, concrete or wood floors (OR=7.9, P=0.047), poor body condition score below 2.5 (OR=17.1, P=0.020) and use of bedding (OR=12.5, P=0.046) were risk factors associated with dirty legs on calves.

Conclusion: Overall, some calf welfare aspects were adequate for the majority of calves examined, but nearly half of calves had dirty legs, especially in pens with wooden or concrete floors and poor bedding management.

Recommendation: Small holder dairy farmers in Kenya should be trained on calf housing management to improve welfare and productivity.

Keywords: calf comfort, animal welfare, smallholder dairy farms

Meat chicken welfare: what are the current status in Kenyan farms

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The World Animal Protection have developed criteria for welfare assessment for meat chicken. The criteria include a number of factors: stocking density (30 kg/ m^2), growth rate less than 50 g per day, keeping slower growing breeds, continuous access to nutritious diets and water, absence of cages, presence of enrichments for perching and pecking, deep litter spread throughout the shed, dry and friable litter, adequate lighting, proper handling and catching of birds, and keeping records on production activities and product quality. These criteria were applied for large-scale broiler chickens' farms in Kenya to examine effects of environment on productivity and product quality. Data was collected from thirty (30) contract and 31 non-contract broiler farms using a pre-tested questionnaire for these various welfare indicators. The quantitative data were analysed using descriptive and inferential statistics, while qualitative data were analysed using thematic analysis. The estimated stocking density for broiler chickens in contract farms was 21.80 kg/m^2 (95%CI: 18.2 - 25.6), while for the non- contract farms, this was 22.54 kg/m^2 (95%CI: 18.4 -26.8). The estimated growth rate of broiler chickens in contract farms was 51.2 g (95% CI: 50.3- 52), and 42.9 g (95% CI: 40- 45.6) for non- contract farms. The age at maturity for the broiler chicken in contract farms was 34.3 days (95%CI: 33.8 – 34.6), and 38.2 days (95%CI: 36.5 – 39.9) for non-contract farms. Most of these farms kept Cobb 500 breed of chicken with a few farms amongst the non-contract farms keeping Arbor acres. These farms raised chicken in deep litter system, with litter materials spread throughout the shed, and there were no cages in broiler chicken houses. Litter quality in these broiler houses was always dry, but this would be affected by the prevailing weather conditions, besides moist litter occurring around drinkers. But, the broiler farms did not have enrichments including perches or other materials that the birds would peck. In the contract farms, chicken were fed on pelleted and crumbled feed, while for non-contract farms, mash, pellet and sometimes crumble were fed. For the contract farms, a three phase feeding regime was practised: 0.42 kg for starter, 1.26 kg for grower and 1.6 kg for finisher per broiler. The non- contract farms were feeding 1 kg for starter and 3 kg for finisher broiler chicken. Ascites was the main cause of product condemnation for contract farms, but for the non-contract farms, ascites, dead on arrival and state of feather cleanliness were the causes of product condemnation. There was a statistically significant positive relationship between these causes of product condemnation. Furthermore, the mortality rate of 6.4% and 3.1 %, and culling rate of 1% and 0.3% for broiler chicken in the contract and non-contract farms, respectively were statistically different ($P < 0.05$). This study has shown that large-scale broiler chicken farms have adopted most of the welfare criteria for meat chicken, however, most farms had no enrichments for perching, pecking and screening by broiler chickens. The commercial broiler chicken farmers should be trained on appropriate ways of incorporating enrichments within their broiler housings to improve on welfare of these meat chickens.

Keywords: Broiler chicken welfare, contract farming, broiler breeds, meat product quality, broiler productivity

An overview of the impact of international trade in donkey skin on one health and sustainable development goals

Onyango. C.S and Ojwang J.M

There has been a huge surge in the demand for donkey skins leading to unprecedented slaughter of donkeys .This is being primarily fueled by a growing demand for skins in China to manufacture ejiao, a traditional Chinese medicine promoted as having immense benefits in enhancing beauty and sustaining libido. This has seen multiple pressure being exerted on donkey population with China reporting a decline of 50% in their donkey population in just 5 years. Attempts at enhanced breeding

has not being successful since donkeys have long gestation, low fecundity, poor uptake of artificial insemination, high propensity to abortion and stress related mortality. Cruel handling during transport and at slaughter houses coupled with inhumane slaughter in the bush and at slaughter houses compromise donkey welfare considerably. While donkeys might not go extinct, the threat of unsustainable working population is real. Donkeys contribute to about half of the UN Sustainable Development Goals including ending poverty, ensuring decent work and economic growth, access to water, low carbon emission and ending hunger, thus threat of poverty is real as the needs of these communities will be compromised due to increased theft and higher purchase prices attributed to fewer donkeys. The rampant illegal trade in bush slaughtered donkeys that have not had veterinary inspection also pose a health risk to people, with potential of zoonotic diseases and health risk to other healthy equid. The abandoned carcasses from bush slaughter and the massive waste from slaughter houses have also created a major environmental pollution since only the skin is held of value in the production chain. It is a fact that donkeys are quite valuable when alive and are crucial, in securing community livelihoods and achieving overall development. Indeed donkeys are known to contribute significantly to women and youth empowerment.

Key Words: Animal Welfare, Donkey Skin, Livelihood, Environment, Health

Training of animal health providers: the Kenya veterinary association, donkey welfare project experience-Kajiado, Kenya

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The Kenya Veterinary Association through its animal welfare improvement project implements a donkey welfare project in Kajiado County. The Brooke East Africa has been funding the Kenya Veterinary Association to implement the project since June of 2013. Availability of quality veterinary services, has been identified as essential pillar in holistically contributing to improved donkey welfare. Among the objectives of the Project is to impart equine (donkey) knowledge and skills to practicing veterinarians and paraprofessionals to improve their capacity for effective equine service delivery. Approaches used in this context include; one on one work based assessments, phone consultations and workshop trainings.

Since 2015, the Project has progressively recruited animal health service providers to its mentorship programme. The number stands at 25 as of March 2018, from 11 during project inception. Their progression against identified competencies is tracked, scored and graded in a process dubbed Clinical Quality Monitoring. The grading system has grade A (70-100%), B (50-69%) and C (0-49%). In 2016/17 financial year (April -March) 40.75%, 32.75% and 26.25% of trainees scored grade A, B and C respectively (n=25) and in 2017/18; 23%, 51% and 26% scored grade A, B and C respectively. A drop in Grade A's was reported and an increase in Grade B's noted between the two years, the number of trainees with Grade C remained largely unchanged. Clinical Quality Monitoring offers an exciting, experiential, competency- based learning approach that is replicable and can be easily adopted for training learners in other desired areas of focus.

Mapping Nairobi's dairy food system: an essential analysis for policy, industry and research

Stella Kiambi, Pablo Alarcon, Jonathan Rushton, Maurice Murungi, Patrick Muinde, James Akoko, Gabriel Aboge, Stephen Gikonyo, Kelvin Momanyi, Erastus Kang'ethe and Eric M. Fèvre

Demand for dairy products in sub-Saharan Africa, is expected to triple by 2050, while limited supply is predicted. This poses significant food security risk to low income households. Understanding how the dairy food system operates is essential to identify mitigation measures to food insecurity impact. This study aims to determine the structure and functionality of Nairobi's dairy value chain (value chain mapping).

Primary data were gathered through focus group discussions and key informant interviews with dairy value chain stakeholders in Nairobi to obtain qualitative information on people and products in the

chains while describing their interactions and flows. Qualitative thematic analysis combined with flowcharts created by participants enabled identification of key food system segments and the development of chain profiles (or flow-diagrams) which together form the Nairobi's dairy system.

Seven chain profiles forming the Nairobi's dairy value chain were identified. These were found to be predominantly of small-scale individuals who mainly operate independently. Profiles of the urban and peri-urban farming systems were structurally similar in their downstream networks, obtaining inputs from similar sources. Upstream, the urban systems were shorter supplying mostly to immediate neighbours or based on own consumption, while the peri urban systems supplied to a wider network and showed some affiliations to producers associations. Two profiles characterize the milk flow from traders belonging to the Dairy Traders Association (DTA) and those not belonging to this association (Non-DTA). Main differences relates to the selling of products, with DTA traders selling mainly to fix retailers and non-DTA to mobile retailers (hawkers or roadside vendors). Profiles associated with medium and large cooperatives were driven by collection centres, but with medium cooperative selling half of their production to large processing companies, and large cooperatives only to fix retailers. Large processing companies' profiles indicate distribution of high volumes and to perform value addition. They reported strategic milk collection arrangements with suppliers on long, medium or short term contracts and with well-established products distribution channels.

In conclusion, the numerous inter-linkages identified across the profiles demonstrates interdependency among the stakeholders. Therefore enhancing the system's efficiency requires a holistic approach and any policy interventions should consider every segment of the value chain towards enhancement of the entire dairy food system. This study provides a methodological approach for organizations and policy makers to understand and address structural and functional vulnerabilities within food systems.

The effects of climatic change on livestock health in the central counties of Kenya, a study done using participatory epidemiological methods

Waweru Kabaka, Thomas Manga and Jeffrey Mariner

This describes a participatory epidemiology study conducted from 1st June to 30th June 2017. The objective of the study was to assess the climatic change as it is perceived by the people of central Kenya and it association to livestock diseases, disease vectors, and livelihood challenges using participatory method. The study was conducted in three of the four districts touching Mt. Kenya. Four sites were selected in each district, where focused group discussions were held to collect data on climate change, livestock diseases, community conflicts and change of livelihood over time.

This study revealed that there has been a general increase of ambient temperatures and a decrease in rainfall, which has also exhibited erratic patterns swinging from droughts to floods. The respondents have seen evidence of the global warming and the shrinking mountain cap glacier in just 20years. The main sources of livelihood were crop farming (41%), livestock farming (15%), business (18%), employment (12%) and others (14%). A shift of livelihood from livestock rearing to other types of livelihood has occurred due to the continuous depletion foliage.

A Disease impact Matrix Scoring (DIMS), revealed that diseases with the biggest socio-economic impact in cattle were, East Coast Fever (ECF) (51%), Anaplasmosis (29%), Babesiosis (11%), Anthrax (5%) plant toxicity (3%) and others (1%). Diseases of goats were Contagious Caprine Pleuro-pneumonia (CCPP) (49%), non specific pneumonias (19%), helminthosis (21%), wild life predation (6%), and others (5%).

A community action plan to participate in reducing global warming was identified as planting more trees on their farms. Use of bio-gas fuel and reduced usage and burning of plastic bags were also discussed as possible actions.

Analysis of pastoralists' perceptions and risk of brucellosis in Kajiado county, Kenya

Penina Mutua

Background: Brucellosis is one of the neglected bacterial zoonosis with global distribution, and some cultural practices contribute to its transmission. The objective of this study was to assess pastoralists' knowledge and perceptions on brucellosis and the risk of exposure to human brucellosis by pastoralist community living in Kajiado County of Kenya. Risk assessment for exposure was conducted according to CODEX Alimentarius risk assessment framework.

Methodology: The County has two main livestock production systems: livestock farming practiced in the interior rural areas (rural pastoralism system) and mixed livestock and crop farming practiced around the towns (peri-urban agro-pastoralism system). A cross-sectional survey was conducted in two purposively selected sub-counties: Kajiado Central representing the rural pastoralism system and Kajiado East representing peri-urban agro-pastoralism system. Eight Focus Group Discussions, four from each sub-county were conducted. The data collected touched on livestock diseases perceived to have great impact on livestock production, impact of the listed diseases on various production parameters, the participants' knowledge on brucellosis in animals and humans, the factors contributing to spread of brucellosis in man, and Participants' perceptions on impact of human brucellosis. The data was analyzed using both descriptive and inferential statistics. Kendall's coefficient of concordance was used to measure the level of agreement on rank order for livestock diseases among the groups.

Results: CCPP, FMD and LSD were associated with the greatest impact on production parameters mainly mortality and milk yield, hence were ranked high, while brucellosis was ranked low (Z-score of -0.99). Only two peri-urban groups had heard of brucellosis in livestock but all the groups had heard of brucellosis as a human disease thus general participants knowledge on brucellosis in animals was low. Consumption of raw milk and undercooked meat were suggested as the possible sources of human infection. Treatment of brucellosis in man was perceived to impact highly on household income. Handling birth contents without gloves and consumption of unpasteurized milk were associated with high risk of exposure among the pastoralists. The risk of exposure was however estimated to be higher among the rural pastoralism system.

Conclusions: Public education is crucial for awareness creation about the risk of brucellosis in humans and livestock. In addition, collaboration between the departments of human medical services and veterinary services in disease surveillance and control is essential.
Key words: Neglected zoonoses, risk of exposure.

Assessment of community behaviours towards anthrax disease in Transmara East, Narok County, southern Kenya, February 2018

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Background: Human anthrax infection is correlated with incidence of anthrax in animals. Sporadic outbreaks in Transmara East Sub County in Kenya have been reported. Local knowledge, attitude and practices (KAP) influencing transmission are not well understood. We sought to assess local community behaviours towards anthrax.

Methods: We conducted a cross-sectional survey of a random sample of households in villages from selected wards from 11thto 21st February 2018. Data were collected using mixed methods; structured questionnaires, focus group discussions (FGDs) and key informant interviews (KII).We sought information on socio-demographics and KAP towards anthrax. Data was analyzed using Ms. Excel

and content analysis. Household questionnaire data was presented descriptively while qualitative data was transcribed and coded to identify various emerging themes.

Results: We interviewed348 respondents, held 3 FGDs and 5 KII. Overall, 99% (345/348) of respondents had heard of anthrax. Knowledge of anthrax varied; 62% reported bleeding from body orifices, < 5% mentioned sudden death in animals and 95% (329/345) knew of cutaneous anthrax symptoms. Knowledge of other forms of anthrax was poor and 75% (256/343) knew of livestock vaccination. Indicative transmission routes were; eating infected meat82% (283/345), contact with infected tissues 64% (221/345) and inhalation of bacterial spores 2% (8/345). Both survey and qualitative interviews indicated low vaccination rates, attributable to inadequate veterinary services and logistical challenges. Discussions elucidated traditional meat safety procedures and skinning of animals before disposal. Practices were also varied; 5.3% (18/342) reported animal deaths to veterinary officers, 44% (151/342) skinned and 46% (159/342) ate, sold or shared cadavers with community members.

Conclusions: Communities in Transmara have varied knowledge on anthrax disease and engage in behaviour that may increase their exposure to anthrax. We recommend intensified health education campaigns, strengthening of veterinary services and Narok County should prioritise anthrax control through animal vaccinations.

Key words: Anthrax, KAP, Mixed methods, Transmara

Determination of peste des petit ruminants positivity and assessment of vaccination coverage for sheep and goats in North Horr sub-county, Marsabit County, Kenya, 2016

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Introduction: Peste des petit ruminants (PPR) stomatitis-pneumo-enteritis syndrome is a contagious, fatal viral disease of goats, sheep, and other small ruminants and a major constraint to small stock keeping among pastoral communities. Prevention and control efforts throughout Kenya have been limited by poor surveillance. This study aims to determine PPR positivity, quantify vaccination coverage, and characterize PPR risk factors associated with spread.

Methods: We conducted a retrospective review of routine livestock health data, January to December 2016, in 5 wards of North Horr Sub-County. Sheep and goats presented for vaccination were inspected for health. Asymptomatic sheep and goats were vaccinated and symptomatic ones were treated.

Exclusion criteria were residence outside the sub-county and symptoms onset or vaccination before or after 2016. Data were entered and cleaned in MS-Excel and vaccination coverage calculated by dividing number of animals vaccinated by total population of animals in the catchment area. Descriptive and associative statistics were calculated with MS-Excel and OpenEpi.

Results: A total of 102,799 goats and 143,790 sheep were included for analysis, in which 100,366 goats and 143,100 sheep were vaccinated; while 2,433 goats (2.37%) and 690 sheep (0.48%) were symptomatic, whereas 100,366 (14.37%) goats and 143,100 (20.95%) sheep out of the total population of the catchment area were vaccinated.

Temporal analyses showed that 91% of PPR cases occurred in the dry season, and 90.55% of cases were clustered in 3 of the 5 wards.

Analyses showed that disease is associated with species (goats), OR=5.03 (4.62-5.47); and (ward): Illeret, OR= 6.25 (5.14-7.61), Turbi OR= 5.74 (4.95-6.66), North Horr OR= 5.16 (4.39-6.06) and Dukana OR = 2.34 (1.84-2.97).

Conclusion: PPR is common in goats especially in dry months and therefore vaccination targeting higher population of animals should be done before dry season.

Key words: Peste des petits ruminantes, vaccination strategy, sheep and goats

A successful vaccine trial reveals an opportunity to control wildebeest-associated malignant catarrhal fever in cattle

Elizabeth Cook

Background: Wildebeest associated malignant catarrhal fever (MCF) is a fatal disease of cattle caused by alcelaphine herpesvirus (AlHV). Pastoralists in wildebeest endemic areas report MCF to be one of the most important diseases of cattle. The incidence can reach 10% in affected herds.

Objectives: The aim of this study was to assess the efficacy of an attenuated AlHV C500 vaccine for preventing mortality from MCF in cattle.

Methods: The study was conducted at Kapiti Plains Ranch, east of Nairobi. In 2016, 146 cattle were selected for a randomised placebo controlled trial. Animals were stratified according to breed and age and randomly assigned vaccine or placebo treatments. Animals received prime and boost treatments one month apart. The study herd was grazed with wildebeest from one month after booster vaccination.

Results: All vaccinated animals were shown by indirect ELISA to have a serological response to vaccination. Three animals (two vaccinated and one placebo) died of unrelated causes before the study ended. Twenty-five animals developed clinical MCF; four of the 71 vaccinated animals (5.6%; 95% CI 2.3-13.6%) and 21 of the 72 unvaccinated animals (29.2%; 95% CI 19.9-40.7%). All affected animals died and the cause of death was confirmed to be AlHV by PCR and histopathology. The vaccine efficacy was determined to be 80.8% (95% CI 78.0-83.6%).

Conclusions: The AlHV C500 vaccine appears to be a safe and effective method for controlling wildebeest associated MCF in cattle in Kenya.

Keywords: Malignant Catarrhal Fever, wildebeest, alcelaphine herpesvirus 1

Protective efficacy of different vaccination regimes against Newcastle disease and infectious bronchitis viruses in broiler chickens

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Infectious bronchitis (IBV) and Newcastle disease viruses (NDV) are devastating respiratory viruses affecting broiler industry worldwide. In this study the efficacy of different combined bivalent inactivated vaccines (BI-IBND) was evaluated against virulent IBV variant-2 virus challenge in commercial broilers. Eight groups (35 birds/group) of commercial broilers were used. Group-1served as unvaccinated control group. Group-2 was vaccinated at D1 with live (NDV+IBV) only. Groups-3, 4 and 5 were vaccinated at D1 with live (NDV+IBV) and boosted at D7 with 3 different BI-IBND vaccines. Finally, groups-6, 7 and 8 were vaccinated at D7 only with different BI-IBND. Post-vaccination (PV) IBV and NDV antibody titres were monitored on weekly basis using HI and ELISA tests. At D28, all groups were challenged with $10^{5.5}EID_{50}$/bird of virulent IBVvariant-2 virus through oculo-nasal route. IBV virus detection in trachea and

kidney was conducted at D3, D7 and D10 PV and post-challenge (PC) using RT-PCR. Results showed that groups 3, 4 and 7 had significant higher antibody titers against NDV (P>0.5) starting from 21 DPV. The antibody response for IBV vaccination, using M41&D274 antigens, were significantly higher in G-2, 3, 4 and 5 at D7. A clear booster effect in BI-IBND boostered groups was detected at D14 PV. IBV was detected by RT-PCR in tracheas of all birds received live vaccine at D3PV only, however, the virus was detected in kidney until D7 PV only. The challenge IBV virus shedding through trachea was detected up toD7 PC, while in kidneys the virus shedding persisted to D10 PC. Based on both serology and tracheal virus detection, MEVAC IB+ND® showed the best protection compared to other BI-IBND vaccines. In conclusion, the prime/boost (live/inactivated) showed superior protection against challenge with variant-2 IBV virus. Additionally, MEVAC IB+ND vaccine was more effective to protect chickens compared to other vaccines.

Keywords: IBV, NDV, Broilers chickens, inactivated vaccines, efficacy, combined vaccine.

Hope for improved livestock vaccines in Kenya using the technology of reverse vaccinology

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Introduction: There are many initiatives to develop improved vaccines for priority livestock diseases. The diseases include ECF,PPR,CBPP, CCPP and mastitis while the initiatives include replacement of the Muguga cocktail with the marikebuni strain of the ECF causing parasite, Theileria parva (T. parva); thermo-labile PPR vaccine with heat tolerant version; and the current live T1 44 with CBPP subunit vaccine

The purpose of this paper is to highlight the approach used in developing the CBPP subunit vaccine through the technology of reverse vaccinology and advantages of the technology which has great potential for development of other improved vaccines.

Materials and Methods: In order to shorten the time taken to introduce the new CBPP subunit vaccine to the field, the approach used was to simultaneously carry out proof of concept studies of on station animal challenge trials (25 groups of 8 cattle each) and field socioeconomic studies for challenges of vaccination and preferences of the vaccine

Results: On station efficacy observed at 80%. Product now at manufacturing stage before pilot introduction to the field. Challenges to be encountered when introducing to the field documented

Conclusion: Unlike live attenuated vaccines, those produced through this technology are thermo-stable, do not pose the risk of reversion to virulence, have along duration of protection and show promise for use in diagnostic kits that differentiate infected from diseased animals (DIVA). These advantages have encouraged commencement of efforts to apply the technology on vaccines for other diseases, including CCPP caused by *Mycoplasma capricolum* subsp *capripneumoniae*, and mastitis in camels caused by *Streptococcus agalactiae.* Initially, screening tests for the vaccine products were carried out at VIDO Canada. However, technology transfer has enabled Kenya to carry out laboratory screening tests.

Keywords: Reverse vaccinology, CBPP, Vaccines.

The impact of ancestral dioxin exposure on *cyp1a1* promoter methylation

Hesbon Amenya, Chiharu Tohyama and Seiichiroh Ohsako

Environmental chemicals have the potential of inducing permanent epigenetic changes that may impact tissue function across generations. I examined the epigenetic changes across three generations of mice that were derived from both adult males directly exposed to 2,3,7,8 tetrachlorodibenzo-*p*-dioxin (TCDD) designated as aTCDD, and *in utero* TCDD exposed males (*iu*TCDD).

There was significant liver *Cyp1a1* hypomethylation in directly exposed F_0 aTCDD males. However, this epigenetic change was reset in the F_1, F_2 and F_3 generations. Similarly, in the *iu*TCDD group, there was *Cyp1a1* promoter hypomethylation in the F_1 mouse liver, which was followed by a slight hypermethylation in the F_2 progeny and recovery of the methylation levels to the control group levels in the F_3 and F_4 generations. The biological consequence of these epigenetic changes in the liver was a diminished *Cyp1a1* response to a subsequent dose of dioxin up to the F_2 generation of aTCDD, and the F_4 of the *iu*TCDD group. To understand whether these phenomena correlated with, or had a basis in sperm epigenetic changes, I measured the sperm *Cyp1a1* promoter methylation across all generations. In the aTCDD group, there was *Cyp1a1* hypomethylation in the F_1 progeny. On the other hand, the *iu*TCDD males had little or no methylation change from the F_1 to the F_4 generation.

The findings in this study indicate that ancestral TCDD exposure alters the *Cyp1a1* epigenetic status and xenobiotic response in descendant generations, but these epigenetic changes are not transgenerational.

Key words: dioxin, *Cyp1a1*, DNA methylation, transgenerational epigenetic inheritance

Capripox disease outbreak in endangered wildlife species in a wildlife park

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Capripox viruses comprise Sheep pox, Goat pox &Lumpy skin disease Virus (LSDV) in thePoxviridae family. Sheep pox and Goat pox mainly affect domestic sheep and goats, respectively, and LSDV affects cattle and domestic Asian buffalo. Clinical field infection has been seen in a few wildlife species including; giraffe, impala, springbok and Arabian oryx.

A number of wildlife species including (Arabian oryx, springbok, mhorr gazelle, dama gazelle, barbary sheep, Arabian gazelle) kept in a wildlife park were affected during a recent outbreak. Other species sharing same environment (scimitar horned oryx and speke's gazelle) were not affected showing lower susceptibility/resistant levels as compared to other species. This paper describes clinical manifestations of the outbreak, diagnostic methods used to confirm the disease outbreak, control measures and lessons learnt.

Molecular epidemiology of African Horse Sickness in Kenya

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African horse sickness (AHS) is an infectious and non-contagious disease of equidae transmitted mainly by *Culicoides* spp. (biting midges), hence, the disease has a seasonal incidence. Windborne dispersal of infected vectors over long distances has been reported. The disease is endemic in most parts of tropical Africa. Mortality rate frequently exceeds 90% in horses. The infectious agent is a double stranded RNA virus, within the genus *Orbivirus* of the Reoviridae family. Nine different AHS-virus serotypes (AHSV 1-9) have been recognized. The objective of the study was to determine AHS serotypes circulating in Kenya. Horse owners have been losing horses to AHS, despite vaccinating

with AHS vaccine from Onderstepoorst Biological Products. The vaccine is formulated in two components, which have to be administered two or three weeks apart: (1) trivalent, containing AHSV-1, 3 and 4; (2) tetravalent, containing AHSV-2, 6, 7 and 8. The vaccines does not include AHSV-5 and AHSV-9 Samples were collected from 32 horses (19 dead, 13 live), in different geographical areas mainly from Nanyuki (n=12), Nairobi (n=6), Naivasha (n=9) and Nakuru (n=5) areas. The horses showed different clinical signs but mainly; the peracute or acute pulmonary form characterised by high fever, tachycardia, severe pulmonary oedema, dyspnoea and agonally a frothy nasal discharge before dying. Few showed the cardiac form characterised by fever, oedema of head, petechiae on the ventral surface of the tongue, tachypnoea and tachycardia. Paired serum samples taken from 13 live animals, while 19 heparinised blood, spleen lung and lymph node samples were taken during post mortem (preserved in 10% buffered glycerine) and was transported at 4°C to the Central Veterinary Research Laboratory,(CVRL), Dubai for molecular analysis. Out of 12 samples collected from Nanyuki area, 7 were from dead horses (4 non-vaccinated and 3 vaccinated), AHS virus strains 1, 4, 5 and 8 were isolated. Of the samples from the 5 live horses, 4 had AHSV2, while one with AHSV4. All samples collected from Nairobi area had been vaccinated, 3 died and AHSV2, AHSV4 and AHSV9 isolated, of the 3 live ones, 2 had AHSV2 and one had AHSV3. Of the samples from Nakuru and Naivasha region, 9 samples (all dead) had AHSV2, AHSV4, AHSV5, AHSV7and AHSV9 serotypes and the 5 samples from live horses, AHSV4, AHSV5, AHSV7 and AHSV9. From these preliminary results we concluded that the horses in Kenya should get vaccine with all the 9 serotypes since all serotypes are circulating in Kenya.

Keywords: African Horse Sickness, Serotypes

Molecular epidemiology of spotted fever group Rickettsioses at the wildlife-livestock interface in Maasai Mara and Laikipia ecosystems, Kenya

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Spotted fever group (SFG) rickettsioses are zoonotic diseases caused by the intracellular bacteria *Rickettsia* sp. The study investigated the presence, prevalence and species of SFG rickettsiae in wildlife hosts and their ticks in two unique wildlife–livestock interfaces of Laikipia and Maasai Mara (MM) ecosystems, with the aim to determine the potential risk of transmission to livestock and humans. For this purpose, blood from 79 and 73 animals in Laikipia and MM, respectively, and 756 and 95 ixodid ticks in each of the areas, respectively, were analysed using molecular tools. Ticks were separated into pools of 1-8 non-engorged ticks according to species and animal host before analyses. SFG rickettsial DNA was detected in some wildlife hosts but at low prevalence of 2/79 (2.5%) and 4/73 (5.5%) in Laikipia and MM, respectively. SFG rickettsial DNA was also detected in several tick species. The overall maximum-likelihood estimates of tick infection prevalence (pool-adjusted) were 4.29% (95% CI: 0.5-8.81) and 5.38% (95% CI: 1.96-11.21) in Laikipia and MM, respectively. In Laikipia, rickettsial infections were detected in *Rhipicephalus* sp.and in MM in *Rhipicephalus* sp, *Hyalomma* sp and *Amblyomma* sp. Infected ticks were collected from Cape buffaloes, Topi, blue wildebeests, Coke's hartebeest, common waterbucks and common zebras. Phylogenetic analyses revealed that all *Rickettsia* isolates were of a subspecies of *Rickettsia sibirica* closely related to *Rickettsia sibirica mongolotimonae.* The presence of SFG rickettsia suggests wildlife and ticks play a potential role in their epidemiology in Laikipia and MM. This warrants further studies to determine how human residents and livestock cope with these infections. The findings demonstrate the need to sensitise local residents about the diseases.

Key Words: spotted fever group rickettsioses, wildlife-livestock interface

Study of Middle East Respiratory syndrome-corona virus in the dromedary population of Kenya

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Since the discovery of the Middle East Respiratory Syndrome- Corona Virus (MERS-CoV) in 2012, World Health Organization has documented 2,143 laboratory confirmed cases with 35% mortality. Although the epidemiology of MERS-CoV is poorly understood, dromedary camels have been suggested to be reservoirs owing to genetic similarities of the virus isolated in humans and that of camels. The current study sought to describe the sero-prevalence and identify the MERS-CoV circulating in camels in Kenya.

A cross sectional study was carried out in five counties (Turkana, Isiolo, Marsabit, Laikipia and Nakuru) and longitudinal studies rolled out in Isiolo (repeat cross-sectional) and Nakuru (cohort) counties between July 2016 to September 2017. Approximately 2,829 camels were sampled during the cross sectional studies. Longitudinal surveillance involved follow up of three herds in Isiolo County with once a month sampling for six months and a cohort follow-up of approximately 70 camels over seven and half months with sampling intervals of 14 days.

The overall sero-prevalence of MERS-CoV was 61% ranging from 14% (Nakuru, N=50), 15% (Laikipia, N=181), 68% (Turkana, N= 417), 74% (Marsabit, N=370) and 78% (Isiolo, N= 403). The sero-prevalence from the longitudinal (repeat cross-sectional) study was approximately 68% (N=285). Five of the 2,241 nasal swabs tested with PCR were positive for the MERS virus. These sampleshad been obtained from two herds in Isiolo County. Apart from one camel that was more than three years old, the rest were less than one year of age. The PCR results revealed that the virus circulating in the camels in Kenya is similar to what has been identified in Egypt and Nigeria (not clade A and not clade B) but is different from what has been shown to cause human disease outbreaks in the Middle East and in other parts of the world (clade A and clade B).

More research is recommended to examine the virus diversity in camels and to investigate if there are also clade A or clade B MERS-CoV in Kenya to explore the risk of recombination with the already detected non-A, non-B MERS-CoV.

Leadership and ethical governance issues in County Governments

Hygynus Asoka Itur

Introduction: Leadership represents the organization of people into manageable groups and influencing them to a specific direction for the purposes of harnessing available resources for the general good of all. Whereas, integrity refers to the quality of being honest and having strong moral principles that you refuse to change: or rather; someone's high artistic standards or standards of doing their job, and that person's determination not to lower those standards. This paper analyses emerging issues in leadership, governance and integrity in County Governments focusing on analyzing the challenges of leadership, governance and integrity and assessing the available checks and balances to address the aforementioned challenges.

The paper is based on qualitative research stressing on the socially constructed nature of reality in regard to leadership, integrity and governance issues in County Governments.

It’s quite clear that issues such as; new dispensation (devolution), capacity of county governments, human resource issues, financial constraints and the socio-economic-political environment in all determine effective leadership, integrity and governance. However, it’s also noted that County Governments have various checks and balances namely; internal and external audit and County Assembly Committees. To confront the challenges of leadership, governance and integrity issues in County Governments; mechanisms that aid in continuous improvement such as monitoring & evaluation are employed.

Key Words: Leadership, Integrity and Governance

A review of policy domestication approaches for intergrated planning in the agriculture sector

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The Constitution of Kenya 2010 brought reforms in the institutional arrangement in Kenya such as the two levels of government. The two levels of government were to address mandates as spelt out in schedule four of the Constitution. Within the agriculture sector a number of new institutions were created through the Intergovernmental relations Act of 2012.

Among the institutions created were the intergovernmental sectoral forums. One of the key functions of the National government was development of polices, legislation and standards while the County governments were tasked to implement the policies. Within the first five years of devolution a number of polices, strategies and management plans were developed by the National government while at the same time a number of counties developed their own county specific policies.

The policy instruments were meant to guide the delivery of services to a common target population at the same time ensuring alignment to other regional, continental and global initiatives. The intergovernmental agencies were to ensure consultation and cooperation between the two levels of government ensuring policies and other planning documents in the sector were harmonised. The Agriculture Sector experienced challenges in ensuring the policies were aligned. Policydomestication approaches were applied to deliver consultation and cooperation inthe agriculture sector.

The lessons learnt could be used to inform delivery of service in other devolved sectors.

Key words: Agriculture Sector, Services, Policies, consultation, Governments

Assessment of the veterinary laboratory capacity and performance using FAO laboratory mapping tool, Kenya 2017

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Prompt and effective laboratory diagnosis remain the bases for a good national epidemio-surveillance. In Kenya, veterinary laboratory capacity strengthening has focused on individual skills or institutional processes, and excluded the laboratory functionality. The implementation of the functionality component is crucial to identify diagnostic laboratory's gaps, focus on specific laboratory strengthening, and develop strategic plans to meet key operational challenges of the laboratory to aid effective, prompt and reliable diagnosis. In laboratories, rigorous methods to continuously assess implemented initiatives are scarce. To address these gaps, the Laboratory Mapping Tool (LMT) was developed by FAO in 2010.

We conducted a laboratory capacity assessment in the Central Veterinary Laboratories (CVL) in Kenya using LMT's detailed and standardized questionnaire and by plotting graphs and tables with digital application.

Using a systematic participatory approach, the LMT was administered in seven laboratories (Pathology, Bacteriology, Virology, Molecular biology, Helminthology, Acarology and Chemistry) and a standardized scoring matrix was employed. While future planning of the laboratory were

excluded, on-going developments and visible preparations were included in the assessment. Results indicated an average performance for the general laboratory profile (>55%); Laboratory performance Infrastructure, Equipment and Supplies was slightly below average (<50%); Quality Assurance and Biosafety/ Biosecurity, Laboratory Collaboration and Networking were below average (<40%).

This assessment serves to establish a baseline for Kenyan CVL prior to intervention. Future targeted plans should consider the outcome of this assessment and the tool can serve as a model for other countries in the Region. The participatory approach ensured integration, better quality and ownership of the results, and provided critical information to help decision- makers determine where to prioritize finite resources.

Key words: Laboratory Mapping Tool, assessment

An evaluation of the subsidized artificial insemination programme implemented by the government of Makueni County

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Government of Makueni County.

The Government of Makueni County has implemented the subsidized Artificial Insemination Programme since July 2014 with the objective of supporting dairy farmers of Makueni County to improve and upgrade their dairy breeds in order to support assurance of food security and improvement of socio-economic status and nutritional quality of the small scale dairy farmers of Makueni County. At the time of starting the county AI programme in 2014, this service was very expensive and only available to the rich. The service was provided at a cost ranging between Ksh 1,400 and Ksh 2,500 depending on the service provider and distances covered. The programme is implemented through partnership between the Government and the private sector. All the inseminators are private, being either individuals or dairy cooperative societies. The Government provides the inputs and pays the service providers to deliver the service. The general objective of the evaluation of the programme was to assess the level of success in the implementation of the county AI programme. By May 2017, some 6,042 farmers had used the service and these formed the sampling frame from which a sample of 600 was picked using cluster random sampling where the farmers were grouped into clusters according to their geographical location. The study used a structured interview schedule which was administered by phone to the sampled farmers. The data was analyzed using SPSS statistical package and MS Excel and presented in form of narratives, tables, graphs and in percentages. The SPSS analysis focused on frequencies, descriptive and correlations.

The evaluation concluded that the programme has reached all wards of the county although at differing levels of intensity. The study also found that the programme had achieved a conception rate of 67% in the first insemination, the calf sex ratio was 47:53 for Male: Female, that 33% of respondents were able to get a calf every year and 88% of the respondents rated the service providers good and very good.

The study recommends that more funding be provided for the programme and provision of more service providers in order to reach more people and enhancement of dairy support services such extension and disease control programmes to ensure the services are sustainably provided.

Trends and level of clinical case exposure for training of undergraduate veterinary students in the university of Nairobi from 1980-2016

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The overall objective was to determine the level of clinical case exposure for veterinary undergraduate students in the Faculty of Veterinary Medicine University of Nairobi from 1980-2016. The specific objectives were: a) to determine the total and annual large-animal clinical caseload, b) to determine the monthly and weekly caseload, and c) to determine the caseload distribution among the subject disciplines and the most prevalent disease condition categories.

All the available Large Animal Ambulatory Clinic and In-Patient case record cards from 1980-2016 were retrieved from the archives of the Department of Clinical Studies. Due to the large number of cards and data, only those of even years 1980, 1982, 1984---- to 2016 were included for the ambulatory cases, but all the years from 1980-2016 were included for In-Patient large-animal cases. Only the relevant data as per the objectives was retrieved from each case-record card. This included year, month, case number, species, disease condition and subject discipline into which the case falls. The data was analyzed using the Microsoft Office Excel 2016 Data Analysis Tools in which occurrences of total caseload, annual percentage caseload, monthly percentage caseload, percentage caseload distribution per subject discipline, species distribution and condition categories was computed.

Results revealed an alarming trend of decline of caseload as years progress. The total estimated ambulatory clinic caseload for 1980-2016 was about 14152 with the highest annual number at 2683 (19.0%) in 1984, lowest 269 (1.9%) in 2016, average annual of 832, average monthly of 69 and average weekly of1.0. The total In-Patient caseload for 1980-2015 was estimated at 5320, highest being 400 (7.5%) in 1989, lowest 57 (1.1%), average annual of 222, average monthly of 18.5 cases and average weekly at 4 cases. However, analysis by the year with the lowest caseload shows average monthly ambulatory caseload of 22 and average weekly of 6; while average monthly In-Patient caseload was 5 and average weekly was 1 case. Approximately 79.8% of the ambulatory cases and 84.4% of the In-Patient cases were seen in the decades of 1980s and 1990s. Over the entire period, the ambulatory cases were 93.1% cattle and the rest of the species <5% each; but the In-Patient cases were 60.4% cattle, 13.2%pigs, 11.9% goats and 11.0% sheep. Ambulatory cases included 49.2% medicine, 30.8% theriogenology and 17.9% surgery. In-Patient cases consisted 44.8% surgery, 29.5% medicine and 17.0% theriogenology. The remaining cases were referred from the clinic for postmortem.

Conclusion made is that exposure of large-animal clinical cases to veterinary undergraduate students in the Faculty of Veterinary Medicine, University of Nairobi has steadily and significantly diminished from 1980 to 2016. Methods of increasing caseload and possible use of teaching alternatives to facilitated student clinical competence should be implemented.

Key words: Clinical competence, Caseload, Veterinary training, Teaching alternatives

Strides in the veterinary profession after the advent of the VSVP Act 2011

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Kenya Veterinary Board

Regulation of veterinary profession in Kenya started in the colonial Government in 1953 through a Veterinary Ordinance. During that time, the provision of veterinary services was mainly by the private sector. After independence in 1963, provision of veterinary services was mainly by public sector and the Veterinary Ordinance became the Veterinary Surgeons Act, Cap 366.

Several amendments were made to the Act between 1964 and 1996 until it was finally overhauled in 2011 to give way to Veterinary Surgeons and Veterinary Paraprofessionals (VSVP) Act, 2011. This Act, upon full implementation will be a very effective tool in regulation of the veterinary profession.

The gains from the VSVP Act include implementation of veterinary internship; introduction of Continuous Professional Development and structured regulation on training and practices.

A survey of ectoparasite burden in households in seven selected counties in Kenya

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Ectoparasites are vectors of important diseases such as malaria, yellow fever and plague. They also cause annoyance and irritation, blood sucking and anaemia, and chronic debilitating diseases. These ectoparasites also play a major role in sustaining ecosystem balance which should be factored in designing control strategies in line with one health approach. Information on ectoparasite burden in Kenyan households is insufficient. This study was conducted with an objective of documenting the common ectoparasites causing burdens in households and challenges relating to their control. A questionnaire based cross-sectional survey was conducted to determine ectoparasite challenge in households in seven select counties in Kenya (Kajiado, Kakamega, Kericho, Nandi, Narok, Nyeri and Siaya). The most common ectoparasites identified were Mosquitoes at 87% (532/611), Flies at 66% (402/611), Ticks at 48% (295/611) and Fleas at 27% (165/611). Fifty percent (306/611) of the respondents associated the presence of mosquitoes with malaria while 10% (61/611)of the respondents associated the presence of flies with cholera. Additionally,5% (32/611)of the respondents associated the presence of ticks to transmission of diseases in animals; while fleas were mostly associated with biting and causing nuisance at 4% (11/611) each. The differences in responses per county are also presented in this paper. The findings of this study reveal that the members of households are concerned about the presence/emergence of ectoparasites in their environments as well as the diseases they can potentially transmit. Further research should be carried out to determine the risk factors at the human-livestock- wildlife interphase, and socioeconomic impact of ectoparasites in Kenya.

Keywords: Ectoparasites, One Health, Kenya, Households, human-livestock- wildlife interphase

Multidisciplinary student- led engagement in community based intervention of one health challenges– a case study of Amboseli ecosystem, Kenya

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One Health (OH) challenges require multi-sectoral and multidisciplinary collaborative approaches that utilize systems thinking approach. However, the training of several key professionals in "one health" has been largely segmented leading to professionals acting in silos, an approach that is not able to tackle OH issues commonly encountered in complex human – livestock - wildlife – environment interface. Field training was carried out with the objective of Inculcating systems thinking and collaboration in the approach to addressing one health challenges among a multidisciplinary group of graduating students through practical field training in the Maasai community. The training was carried out for a multidisciplinary group of thirty-four (34) students comprising of Veterinary, Human, Nursing, Wildlife and Environmental health. Pre-placement training was conducted followed by two-

week long community based field training in Loitokitok, Amboseli ecosystem, Kenya. The students interacted with Masai community members and local stakeholders under the supervision of faculty where they facilitated communities to identify and develop strategies to address key OH challenges in their community and develop integrated intervention measures. Jointly brucellosis, Coenurosis, open defecation (OD) and bedbug infestation were identified as some of the priority One Health challenges in Amboseli community. The students and faculty helped the community identify intervention strategies based on available community resources including deworming of dogs, digging of pit latrines among others. The training significantly contributed to increasing the critical mass of workforce/professionals capable of addressing OH challenges utilizing a holistic approach and systems thinking. Local stakeholders and communities identified priority one health challenges and developed sustainable interventions that will reduce one health challenges including zoonoses.

Key words: One-Health, Demo site, Multidisciplinary community based training, Systems thinking

One health knowledge, attitude and practices among abattoir workers in Narok County

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Abattoir workers are at risk of contracting zoonotic diseases due to their close interaction with food animals and their products. This risk is worsened by the absence of or inadequate sanitation facilities and equipment in most slaughter houses. The objective of this study was to assess the knowledge, attitude and practices on one-health among abattoir workers.

A cross sectional questionnaire based study was conducted among abattoir workers to determine their knowledge, attitude and practices on one-health.

Sixty(60) workers in 4 abattoirs were interviewed. Most (81.7%) of the abattoir workers were aware of one-health challenges including zoonoses that they could contract in the course of their work. Among the zoonotic risks identified, Anthrax was the most reported (71.4%), followed by Brucellosis (43%). Presence of hand wounds (50%), poor hygiene in the facility (51.2%) and lack of or poor water quality (38.8%) was reported as being responsible for their occurrence. Most (96.7%) of the abattoir workers were aware of Personal Protective Equipment (PPE). Although they wore PPEs, only 37.9% did so for protection from diseases, and24.1% for general cleanliness. However 13.8% and 24.1% of abattoir workers cited compliance with the law and identification respectively as the only reason for putting on PPEs. Seventy-five percent (3/4) of the abattoirs had clean water supply, hand washing facilities and toilets but the separation between clean and dirty operations was poorly enforced. Environmental pollution was noted in 50% (2/4) of the abattoirs. Separation of blood and ingesta was also poorly carried out.

Despite the abattoir workers in this study being knowledgeable on zoonotic diseases, their current practices increase their occupational risks. There is need for training programs targeting abattoir workers to improve their awareness on zoonotic disease risks, improve compliance with preventive measures and enhance consumers' safety.

Key words: Abattoir workers, One-health, Knowledge attitudes and practices

Prevalence of hydatidosis in cattle, sheep and goats slaughtered in an export slaughterhouse, Kenya

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Introduction: Hydatidosis is a common parasite encountered in gross meat inspection. It is one of the highest contributor of economic losses due to organ condemnation. If humans consume infected carcasses, they often develop debilitating disease that is very difficult and expensive to treat. Information on the prevalence of Hydatidosis in cattle, sheep and goats slaughtered in export facility in Kenya is limited. This study was carried out with an objective of documenting the prevalence, organ distribution and infection density of Hydatidosis in cattle, sheep and goats slaughtered in an export slaughterhouse in Kenya.

Methodology: A cross sectional observation study was conducted between May and June 2017. Ten percent of animals slaughtered daily were sampled using systematic random sampling and included in the study until a target number of 150 per species was achieved. Information relating to animal identity, source County, hydatid presence, affected organ and number of cyst per organ was collected.

Results: A total of448 animals (150 Cattle,150 sheep 148 goats) were included in the study. During analysis two (2) goats were excluded from the study due to incomplete information. The prevalence was highest in sheep (13%) followed by cattle (7%) and was least in goats (6%). The most affected organ was the liver with a prevalence of 6% in cattle, 15% in sheep and 7% in goats. Animals kept under pastoral system had prevalence of19%,10% and 9% in sheep goats and cattle respectively No case was reported in animals kept in the ranches.

Conclusion: This study documented high prevalence of Hydatidosis in cattle, sheep and goats slaughtered in an export slaughterhouse in Kenya. Control and prevention measures should be enhanced so as to reduce economic losses, eliminate risk of human infections and environmental contamination.

Key Words: Hydatidosis, Post mortem inspection, Pastoralism, Ranching, Cattle, Shoats

Prevalence and factors associated with antimicrobial resistant *Escherichia Coli* from indigenous poultry and farmers in Kitui rural sub-county, Kenya 2017

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Background: Antimicrobial resistance (AMR) is a global threat projected to cause 100 million human fatalities and reduce global economy by $100 trillion by 2050. Inappropriate antimicrobial-use in humans and livestock has been as the main amplifier of AMR however, data on AMR at household level is limited. We estimated prevalence of *E. coli* antimicrobial-resistant and associated factors among indigenous poultry and farmers in Kitui Rural Sub-County.

Methods: A cross-sectional study was conducted between July-November, 2017. Households with ≥ three poultry and farmers aged ≥18 years were include. Random selection of two wards was done and households distributed proportionately to size. Geocodes were randomly generated using ArcGIS to correspond to household to sampled. Structured questionnaire were used to collect data on socio-demographics, poultry husbandry and human-poultry antibiotic use. Farmer's stool sample and pooled cloacal swabs from three poultry per household were collected, *E. coli* isolated, identified and tested

for drug sensitivity using disc diffusion assay. Multidrug resistance (MDR) was defined as resistance to ≥ 3 drugs of different classes. Data were analysed using Epi Info 7. We calculated descriptive statistics, odds ratio (OR) and factors with *p*-value ≤ 0.05 considered statistically significant.

Results: We enrolled 134 farmers (mean age of 45 years), 134 stool and cloacal samples collected. Antimicrobial use in poultry was 57 (43%) and 101 (75%) in farmers'. *E. coli* was isolated from 103 (76%) poultry and 95 (70%) farmers' samples. Antimicrobial resistant *E. coli* testing was done in 90 (87.4%) poultry and 83 (87.4%) farmers. *E. coli* AMR to at least one antibiotic was 84 (93%) and 76 (91.5%) in poultry and farmer respectively. In poultry AMR in tetracycline 42 (46.6%), ampicillin cloxacilin 41 (45.5% and streptomycin 35 (38.9% were the highest in that order while in farmers, tetracycline 34 (40%), streptomycin 32 (38.6%) and ampicillin cloxaccilin 30 (36.1%) showed the highest AMR. Susceptibility was detected in meropenem 81 (97.8%), ceftriaxone 80 (96%) and ciprofloxacin 78 (93%) in farmers and ceftriaxone 88 (97.8%), ciprofloxacin 86 (95.5%) and meropenem 83 (92.2%) in poultry. Multidrug resistance (MDR) was observed in 59(65%) poultry and 49 (59.7%) farmers. Of the *E. coli* isolates, 34 (33%) poultry and 37 (39%) farmers' had similar AMR profiles. There were no statistically significant factors associated with antimicrobial resistant *E. coli* in relation to poultry husbandry or antibiotic use in both human and poultry.

Conclusion: Most of *E. coli* isolates were resistant with high levels of MDR in both poultry and farmers'. There were considerable phenotypic similarities between *E. coli* resistant isolates in poultry and farmers. There is need for enhanced community awareness, surveillance and stewardship activities on antimicrobial use combined with genotyping.

Key words: Antimicrobial, Resistance, Poultry, Farmer, *E.coli.*

Sero - epidemiological survey for acute Q fever antibodies and risk factors among patients with febrile condition in two hospitals in Busia County

Maurice Karani

Background and introduction: Q fever is a zoonosis caused by Coxiella burnetii. The disease has a global distribution with New Zealand as the exception. There is an increasing number of studies on Q fever especially in developing countries but there exist a paucity of data especially on the prevalence and risk factors of the disease in developing countries.

Objectives: This study aimed at estimating the prevalence of acute Q fever among patient presenting with clinical signs consistent with acute Q fever as well as understand the risk factors for acquiring the disease.

Methods: A cross-sectional survey was carried out in Busia County hospital and Kenya Medical Research Institute (KEMRI) Allupe. Seven hundred and three (703) patients presenting with febrile illness were recruited and a blood sample collected, serum was extracted and stored. An in-depth individual interview was administered seeking to understand the presenting clinical signs as well as possible exposures factors relating to Q fever epidemiology. Later the samples were thawed and tested for Ig M and Ig G phase II antibodies. Regression modelling was employed to obtain the association between the seropositivity and the exposure factors.

Results: The overall antibodies seroprevalence was 3.7 % (95% CI 2.3 - 5.6). Having cattle born in the compound; aOR 2.46 (95% CI: 1.07-5.64) and having goats and sheep born in the compound aOR 3.03 (95% CI: 1.10 - 8.41) were found to be associated with Q fever in the multivariable regression.

Conclusion and recommendation: These results indicate that Q fever may be endemic with a low prevalence in the region suggesting that Q fever contribution to the burden of febrile illness in the regions may be insignificant. We recommend raising awareness among clinicians, and farmers about the disease and Q fever clinical picture as well emphasizing to farmers and animal health workers the need to handle birthing and, or aborting animals with increased care.

Key words: Human Q fever, Coxiella Burnetii, febrile patients

A near real-time livestock-wildlife syndromic surveillance system for early detection and response to biological threats in Kenya

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Background: Early detection of animal disease outbreaks including zoonoses is critical to mitigate impact on human health. The animal health surveillance system in Kenya lacks a real-time disease reporting mechanism. As such, we developed and deployed an electronic syndromic surveillance system(Kenya Animal Biosurveillance System (KABS) in livestock and wildlife. The system integrates a mobile-phone application that facilitates data collection by field officers, and a web-based dashboard that receives data in near real-time and with automated data analysis and feedback.

Methods: The KABS mobile app has separate livestock and wildlife reporting forms, with access based on field officer role. The KABS-Livestock and wildlife form reports nine syndromes as identified by the respective authorities. Data on number of animals affected and clinical diagnosis is reported. KABS was piloted in three counties (Makueni, Nakuru and Siaya) and all wildlife regions, with training of field officers in April-July 2017, and data collection launched in June for livestock and September for wildlife. Frequency data is analyzed using the web-based dashboard and shared with the counties.

Results: Thirty-seven wildlife and 117 livestock field officers were trained on KABS. By December 2017, 91(78%)livestock and 19(51%) wildlife officers had downloaded the app and of these, 79% and 42% livestock and wildlife officers respectively had submitted a report. A total of 1445 livestock syndromes were reported with respiratory and gastrointestinal commonly reported in cattle and goats. For 1138(78%) syndromes with a clinical diagnosis, the most common were east coast fever (15%), rabies (7%),foot and mouth disease (6%), and helminthiasis (6%). In wildlife, Deaths (52%), severe emaciation (29%) and cutaneous lesions (29%) were most commonly reported in zebras, elephants and buffalos.

Conclusions and Future Work: The KABS system for syndromic surveillance in livestock and wildlife was adapted, deployed and used for reporting of animal disease events from validated sources to the national authorities. Enhancing the system to identify potential zoonotic disease events as an early warning system and laboratory diagnosis of the reported syndromes will increase KABS utility.

Use of heifer-plus® to enhance heifer calf pregnancies: a preliminary study in Kenya

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Heifer-plus® is a commercial product that converts conventional semen into sexed and hence increases the percentage of heifer calves born. It is marketed in a kit form where the thawed semen is introduced into the Heifer-plus vial prior to artificial insemination (AI). In this study, however, the Heifer-plus® was pre-mixed with fresh conventional semen and frozen, to ease the process of AI. The pre-mixed product was used to inseminate 36 cows in 3 Agricultural Development Corporation (ADC) farms. These cows were at different lactation stages and of varying parities (i.e. bulling heifers and cows up

to the 10th calving, with the majority having had 2-3 calves). The cattle were then checked for pregnancy by rectal palpation and Ultrasound at 2-3 months post-insemination. The Ultrasound was also used to determine the sex of the foetus. A total of 21 cows were confirmed pregnant which was a conception rate of 58%. Eighteen (86%) of the pregnancies were determined to be heifer calves on Ultrasound examination. Heifer-plus® is cheaper than the commercially available sexed semen and has better conception rates. It therefore provides a cost effective method of meeting the high demand for heifers in Kenya and the region.

Key words: Heifer-plus®, sexed semen, Ultrasound, foetal sex determination, cattle.

Management factors associated with weight gain in dairy calves/heifers on smallholder dairy farms in Kenya

MakauD, VanLeeuwen JA, Gitau GK, McKenna SL, Walton C, Wichtel JJ

Common challenges on smallholder dairy farms (SDF) are associated with water availability, inadequate knowledge and technology on feed conservation, and nutritional management of dairy animals. This study was carried out to determine the factors associated with weight gain in dairy calves of both genders and heifers up to 36 months in SDF in Meru County, Kenya.

A total of 321 calves and heifers (a census) were sampled from 200 randomly selected farms from the 500 farms selling milk to the Naari Dairy Cooperative Society of Meru County. Physical exams and heart girth measurements were carried out on the animals. Farmers were also interviewed between May and August 2015 to answer questions on routine management procedures at the farm. Descriptive statistical analysis and mixed model regressions were used for identification of significant factors ($P<0.05$) associated with estimated average daily weight gains.

The observed average ADG (and s.d.) of calves and heifers in SDF in Naari was 443 ±375 g day^{-1}. In the final mixed model, gender of the principal farmer (highest when both genders were considered principal farmers), and education level of both the women and men farmers were associated with natural log transformation of ADG. There was a significant interaction between the education level of the husband and wife; wwhen the man's education was low (having less than or equal to primary school), log ADG was highest when the woman had not completed primary school, but was lower when the woman had completed primary or secondary education, and substantially lower when the woman had completed college or university. There was also a significant interaction between breed and historical disease on log ADG; disease was associated with a decrease in log ADG in *Bos taurus* breeds, especially in Guernseys, while weight gain in *Bos indicus* breeds was not affected. Supplementing forages given to calves/heifers with quality hay was significantly associated with increased average daily weight gain. Age was also curvilinearly associated with log ADG; growth was highest in pre-weaned calves, whereas log ADG was lower in post-weaned calves and lowest in heifers.

General growth performance of animals on these farms was lower than benchmarked standards recommended for optimum dairy production but within normal ranges for the East African region. It is recommended that basic diets be supplemented with hay, and housing for calves to have wooden or concrete floors for better performance of calves and heifers. Additionally, interventions to support educating women in the community on calf management should be initiated. Better management even for learned farmers would be critical to better calf growth.

Key words: smallholder dairy farms, calves, heifers, average daily weight gain, Kenya

Survival analysis of Red Poll and Red Poll crosses in the lowland tropics

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Red Poll is dual purpose cattle derived from crossing Norfolk cow beef type, red in colour with Suffolk polled bull, a dairy breed dun in colour cattle. The study herd was established in 1999 from a continuous two breed rotational crossbreeding, Red Poll (RP) bulls were mated to Boran (B) cows resulting in F_1 with breed content of 50% RP and 50% B. These cows were sometimes backcrossed to produce genotypes of 75% RP and 25 % B or 75% B and 25% RP. Cattle graze day and night on natural pastures mainly of *Hyperhenia rufa* and *Imperata cylindrical*, mineral licks and water were availed *ad lib*. The main objective was to identify animal outlets and estimate survival curves based on 2691 records of birth, mortality and sales from Homa Lime Co. Ltd farm. Calving year and season, sex and breed were used as sources of variation to monitor survival. The data analysis involved Kaplan-Meier, Log-rank and Wilcoxon test to compare sources of variation. Records were analyzed within three time points: calving to weaning; calving to 720 days old and weaning to 720 days old. Of the data available, 10.93% of all the animals born died, 7.43% sold for breeding, 39.13% sold for slaughter and 4.94% missing. Pure RP had low survival rate at pre weaning compared to 50%RP crosses. This could be attributed to heterotic effect; also crossbreeding with Boran helped the 50% RP to be more adapted. Wilcoxon Regression Model, year and season of birth was not significant ($p< .0062$). When pure bred Boran was compared to pure bred RP, the latter is 0.202 times likely to be disposed. Cox regression proportionality test ($p<0.299$) is not significant hence risk in the model is proportional. Survival curves stratified by sex show that males had lower survival rate post weaning compared to females. Male animals were more likely to exit herd than females, because they were fattened and sold for slaughter or breeding bulls while females were retained longer as replacement stock or sold when in calf as breeding stock to other farmers. There was further evidence that mortality events were spread throughout the year. Considering the higher risk of death among pure RP calves, special attention should be paid to calves in order to minimize losses due to death.

Keywords: Survival traits, Red Poll, lowland tropics

Evaluation of milk yield performance of dairy cattle in smallholder farms in Meru, Kenya

Muraya J, Gitau G K, VanLeeuwen J, Makau D N, McKenna S, Tsuma V T, WichtelJ.

A cross-sectional study was conducted to determine the milk yield performance of dairy cattle in smallholder farms in Meru, Kenya. 200 farms with 1-3 cows were randomly selected from the dairy farmers shipping milk to Naari Dairy Cooperative Society in Meru County. Farms were visited once and structured questionnaires administered for data collection and the cows received a physical examination. A mixed linear regression model with a random effect for farm was fit to determine associations of the logarithm of daily milk production. Significant explanatory cow (breed, weight, days in milk, presence of mastitis at the day of visit) and management variables (dairy meal fed during the last month of pregnancy, other sources of farm income, land allocated for dairy use and man's education level) were identified ($P\leq0.05$).

Farmers primarily reared Holstein-Friesian crosses producing an average daily milk of 7.5 kg, while the least common breed was the Zebu crosses which produced an average of 4.9 kg/day. Heavier cows weighing over 550 kilograms had 9.6% more milk than those that weighed between 400-550 kilograms when all the other variables were held constant. Cows receiving dairy meal in the last month of gestation shown a 32% higher milk production compared to those that received none. Cows with recent history of mastitis had a significantly lower milk production than those without mastitis history, although the association was weak. Presence of other sources of income was associated with 9.4% lower milk yield compared to farmers who did not have other sources of income. There was a 14.3% increase in milk yield for every 25% increase in land set aside for growing feed for dairy cows. Cows in early lactation (<100 days in milk) had 7% more milk than cows in late lactation.

We conclude that cows kept by smallholder dairy farmers in this area have not achieved optimum production levels a situation likely attributed to poor feeding. A further detailed longitudinal study is

needed to understand the associations between the farm and animal level factors on milk production, and thus make optimum recommendations to farmers.

Keywords: Bovine, Milk Production, Feeding, Mixed-Model, Meru, Kenya

Occurrence of bovine mastitis in urban and peri-urban areas of Naivasha

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A cross-sectional study was conducted to determine 1) prevalence of mastitis in dairy cows kept in large scale farms in Naivasha and 2) identify and characterize the causative bacteria including their sensitivities to commonly used antibiotics. Clinical mastitis was diagnosed by examining cows' udders and gross observation of milk. California Mastitis Test was used to detect subclinical mastitis. Bacterial causes were identified by culture and their antibiotic sensitivities investigated using disc-diffusion method. A random sample of 43 cows was chosen from three large scale farms. Prevalence of clinical mastitis was 9.3% while that for the subclinical mastitis was 23.3%. Staphylococci *spp* (77%; 23/30) and Streptococci *spp* (20%; 6/30) were the most frequently isolated bacteria. Seven streptococci and Staphylococci isolates were subjected to antibiotic sensitivity testing using the disc diffusion method. The streptococci were sensitive to ampicillin (86%), streptomycin (71%) and Gentamycin (71%). These isolates were resistant to sulphamethoxazole (86%), tetracycline (71%) and co-trimoxazole (71%). Staphylococci isolates (n=7) were sensitive to streptomycin (86%), gentamycin (71%), ampicillin (71%) and co-trimoxazole (71%). All staphylococci were resistant to sulphamethoxazole. Results of this study showed that mastitis is prevalent among cows kept in large scale dairy farms in Naivasha, particularly in sub-clinical form, and thus concerted preventive and control measures needs to be implemented. Further ampicillin, streptomycin and gentamycin are the antibiotics of choice in treating mastitis caused by streptococci while staphylococcal mastitis can best be treated using streptomycin, Gentamycin, amipicillin and co-trimoxazole. We observed resistance to some commonly used antibiotics and prudent use of antibiotics is therefore recommended, to guard against continued development of antibiotic resistance, and protect human health.

Key words: Antibiotic sensitivity, bacterial causes, bovine mastitis, dairy cows, prevalence, Naivasha

Pathological and molecular characterization of Wooden Breast Disease: An emerging myopathy in commercial broiler chickens

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Background: Wooden Breast Disease (WBD), a novel muscle disorder in the poultry industry is known to frequently affect the superficial pectoral muscles of high-yielding commercial broiler chickens raised in standard modern conditions. With no known cause as yet, the myopathy is characterized by extreme stiffening of the superficial pectoral muscles, resulting in severe reduction in meat quality with subsequent significant economic loss in the poultry industry. Further, it may potentially cause behavioral alterations and reduced welfare in affected birds.

Objectives and Methods: To unravel the morphological changes and molecular events characterizing the pathogenesis of WBD in chickens, a time-series evaluation comprising 285 male broiler chickens was conducted. The chickens were raised at the farm from day-old to 7 weekspost-hatch in conditions mimicking those of commercial settings. While employing blind sampling strategy, subsets of birds were necropsied and superficial pectoral muscles harvested for light microscopy on weekly basis, while biopsy samples were taken from weeks 2 to 4 for gene expression analysis using RNA-sequencing.

Results: Histopathologic evaluations revealed localized phlebitis with perivenous lipid deposition and phlebitis in week 1,focal single-myofibril degeneration in week 2 preceding an inflammatory response to myofibersin Week 3.Lesions from week 4 to 7 revealed varying degree of obstructive phlebitis accompanied by multifocal to diffuse myositis,fibrosis and myoregeneration. On the other hand, gene expression analysis of biopsy samples between affected and unaffected birds revealed top canonical pathways involved in immune and inflammatory response, and PDGF signaling pathway in WBD. Additionally, molecular analysis showed, angiogenesis, fibrosis,oxidative stress and dysregulation of metabolic pathways such as glucose and lipid metabolism in affected birds.

Conclusion: This study demonstrates that morphological and molecular perturbations involving the vasculature, extracellular matrix and metabolism are pertinent to the onset and progress of WBD in commercial meat-type chickens.

Key Words: Wooden Breast Disease, Fibrosis, Modern broiler chickens, Breast muscles, Phlebitis

Sero-prevalence and risk factors of bovine *Neospora* and bovine viral diarrhoea virus infections in dairy cattle in Meru County, Kenya

Muraya J, Gitau G K, VanLeeuwenJ, Makau D N, McKenna S, Tsuma V T, Wichtel J.

Bovine viral diarrhoea virus (BVDV) and *Neospora Caninum* are among the most important pathogens in dairy cattle and are associated with significant economic burden around the world. Losses from reduced milk production, reduced reproductive performance, growth retardation, unthriftiness, losses through abortions, early culling and increased mortalities in young stock have been recorded from these two diseases. The aim of this study was to determine the seroprevalence and risk factors of *Neospora caninum* (NC) and BVDV in dairy cows in Meru County, Kenya. Blood samples were collected from 273 cows in 89 randomly selected farms in the Naari area of Meru County and analysed for seropositivity through ELISA for the two diseases. In total, 53.4% (146/273) were seropositive for BVDV antigen and at least one seropositive cow was found in 76.4% (69/89) of the farms. The final multivariable logistic regression model identified fence-line contact and number of poultry on the farm as the significant factors associated with BVDV infections. In total, 34% (93/273) of the cows were seropositive for NC antibodies and 58.4% (37/89) of farms had at least one seropositive cow. Natural mating, fence-line contact, lending of animals and direct contact with dogs were factors significantly associated with the prevalence of NC in the area. There was no correlation observed between BVDV and *Neospora caninum* seropositivity although co-infections were found in 19.4% of the cows. In the latter group,9% (5/53) of cows were reported to have aborted. The findings of this study indicate that BVDV and NC infections are present in Meru, Kenya, and a number of factors were associated with the infections, and thus, further research needs to be carried out to mitigate the potential reproductive losses associated with these two pathogens.

Keywords: Bovine, Bovine Viral Diarrhoea, *Neospora*, Seropositivity.

Microcardia associated with traumatic Reticulopericarditis (TRP) in an adult female Ayrshire cow: A case report

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A 7 month pregnant Ayrshire cow raised in open fields in Dandora area, Nairobi was presented to the Large Animal Clinic, University of Nairobi, on 6/11/2017 with a history of being off feed for a week and constipation. She had been treated for two weeks with Magnesium Sulphate and gentamycin injection with minimal relief of the bloat and slight improvement in her appetite. A week later, she became completely anorexic and developed brisket oedema.

General exam revealed good body condition, dullness and depression, predominant abdominal breathing, brisket oedema, careful gait, pronounced abduction of elbow, distended jugular vein, grunting and teeth grinding. On physical examination the respiratory rate was 24 breathes per minute, pulse rate of 92 beats per minute, temperature of 40.70 degrees Celsius, splashing heart sound, suppressed thoracic respiration and harsh lung sounds. Results from haematological analysis showed anaemia, evident by decreased haematocrit, haemoglobin concentration and red blood cell count. Leucocytosis, neutrophilia and lymphopaenia was also evident.

A tentative diagnosis of terminal traumatic reticulo-pericarditis was made carrying a grave prognosis. Euthanasia was indicated but the cow died on the night of 8/11/2017.Post mortem revealed hydro-peritoneum, hydro-thorax, three (3) wires piercing through the reticula wall and diaphragm to the pericardial sac, fibrinous adhesions of reticulum, diaphragm and pericardium. Enlarged Pericardial sac with 12 litres of creamy liquefied content with fibrin attachments. The heart was severely atrophied.

This report documents atrophied heart associated traumatic reticulo-pericarditis caused by several wires piercing the diaphragm in a cow raised in peri-urban area. In conclusion, the cow was from an urban farm and farming in such areas is more likely to predispose cattle to TRP due to uncontrolled grazing in urban centred which exposes them to unsafe foraging areas and fodder.

Keywords: Traumatic Reticulo-Pericarditis (TRP), Urban dairy farming, Cardiac atrophy

Effects of river pollution in urban informal settlements on the boar testis

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Concerns confirmed by clinical observation were raised by urban farmers in Nairobi that suggested the presence of endocrine disrupting compounds (EDCs) within the water of Nairobi River that increased incidence of retained testis in piglets.

A study was necessary to verify the concerns of the farmers, test for EDCs in the river water that could affect the testis, and also test the effects on experimentally exposed animals.

Eighty pig farms 50 metres on either side of Nairobi river were purposively selected and questionnaires administered. River water were analysed to determine the levels of two estrogenic endocrine disrupting compounds using Gas chromatography-Mas spectrophotometry. Randomly selected boars raised along the riparians and another 5 from non-contaminated area were acquired, castrated and the seminiferous tubules examined at X200. A group of 10 male mice were kept in the laboratory with access to the suspected water for two months. Similarly, 10 other mice served as the controls. Both groups were castrated to test for any seminiferous tubule lesions.

A Significant number of the respondents were involved in urban agriculture and utilized the water of Nairobi river tributaries. The residents reported that piglets born to sows accessing river water had retained testes. The levels of 17β-estradiol and alkylphenol in the water ranged from non-clinical levels to clinically significant levels of 0.95µg/L and 0.36µg/L respectively. The seminiferous tubules of boars and exposed mice revealed epithelial vacuolations, sloughed germ cells and patches of depleted tubules.

The results of this study suggest presence 17β-estradiol and alkylphenol at levels above 0.1ng/l (shown to be clinically significant) in urban draining rivers capable of affecting testicular descent and the seminiferous tubules histology

Keywords: Endocrine disrupting chemicals, seminiferous tubule histology, urban farming.

Sero-prevalence of bovine leukosis infection in contrasting farming systems in Kenya

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Background: Enzootic bovine leukosis (EBL) is a worldwide occurring disease of cattle caused by the bovine leukemia virus (BLV) and clinically characterized by occurrence of multiple lympho-sarcomas. In Kenya, cases of bovine lympho-sarcomas have been reported but there is limited information on prevalence and distribution of BLV infection in the country.

Objective: The objective of this cross-sectional study was to determine the sero-prevalence of BLV infection in 3 contrasting livestock farming systems in Kenya.

Methodology: In 2016, 1383 bovine serum samples were randomly collected from 14 counties purposively selected to represent 3 livestock farming systems practiced in the country. The sera were tested for the presence of antibodies against BLV using the IDEXX anti –BLV indirect ELISA test.

Results: An overall prevalence of 7.6% (95% CI: 6.3% - 9.1%) was estimated, but infected cattle were only identified in 5 (36%) of 14 counties. A multivariable mixed logistic regression model, with county as a random variable controlling for clustering, identified age and farming system as significant risk factors associated with BLV sero-positivity. Zero-grazing (0.6%), ranching (4.4%) and pastoral systems (18.3%) differed in prevalence. Cattle under 1 year of age had a prevalence of 6.4%, while cattle over 1 year of age had a prevalence of 7.9%.

Conclusion: BLV infection was present across the three farming systems but in only five of the fourteen counties assessed. This information forms a basis for designing control programs for BLV infection in Kenya.

Recommendation: Further research should determine the BLV distribution in other counties, the factors affecting the distribution, and the impact on the livestock industry in Kenya. Keywords: Bovine Leukemia Virus, Distribution, Enzootic Bovine Leukosis, Sero-prevalence.

Integrated approaches to clinical and herd health management in food-producing animals: A review

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Food producing animals make immense contributions to agriculture and human well-being. Availability of a dependable food supply is a major human need, and one of the most important functions of domestic farm animals is the conversion of human in-edible forages, by-products, and crop residues into high-quality human food in the form of meat, milk, and eggs. Animals are also used for weed control, provide draft power, fertilizer in the form manure and often have significant social and cultural value. Disease in farm livestock has always been a problem of considerable importance to farmers. Good livestock husbandry equates with looking after animals properly and maintaining them in good health for optimal production. As production methods intensify, the health status of animals increasingly becomes a primary determinant of productivity on livestock farms. The modern livestock producer has therefore, to actively work with veterinarians and other agricultural specialists who can provide knowledge and skills in order to maintain animal health and production at the most efficient level that provides maximum economic returns. This paper reviews the role of the veterinarian in clinical and planned animal health and production in food-producing animals, particularly cattle, sheep

and goats, and swine. This was done through critical and constructive analysis of relevant literature which was summarised on the basis of the author's experience, existing theories and models. It is established that preventive veterinary medicine has evolved from a purely government sponsored profession aimed at controlling major animal and zoonotic diseases, to treatment of individual animals by private practitioners, and currently to integration of health plans with production and management plans to give whole-farm best effect. There is a need for innovative approaches to health and production in food animals in order to keep pace under the constantly changing environment.

Key words: Clinical, herd health, food animals

Circulating foot-and-mouth disease virus serotypes detected from cattle populations in eight geographical areas of Tanzania

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Foot-and-mouth disease (FMD) is endemic in eastern Africa. Tanzania is placed in pool 4 (Eastern Africa) of the global map of circulating FMD viruses. Understanding circulating viruses in a country is useful in designing control measures particularly the selection of relevant vaccine strains. This study was undertaken to investigate the distribution of FMD virus (FMDV) serotypes currently circulating in different geographical areas of Tanzania. A total of 150 cattle epithelial tissue samples were collected from reported outbreaks of FMD in eight districts within six endemic regions of Tanzania during the year 2016. Laboratory analysis was done by virus isolation in cell culture and serotype-specific antigen detection ELISA. 108 (72%) out of 150 samples were positive for FMDV antigen of various serotypes as follows; 46 (42%) A, 5(5%) O, 29 (27%) SAT-1, and 28(26%) SAT-2. Serotypes A, SAT-1, and SAT-2, were widely distributed in all study areas with serotype A being the most commonly circulating serotype in the field for the period of the current study. Serotype O was only circulating within four districts (Hai, Longido, Ilala, and Mufindi). Seven of the eight districts with reported outbreaks are found in the Eastern-Coastal and Northern zone. Most of the reported FMD outbreaks occurred just after the long rains in June. These findings indicate multiple serotypes and a likely seasonal occurrence of FMD outbreaks in Tanzania. It highlights the need for continuous field surveillance including seasonality factors. Consequently, the findings supports and complements the regional strategy for the Progressive control of FMD (FAO-EUFMD-OIE, 2016) that inquires an updated information on circulating field virus strains in any geographical location to be known for proper selection of vaccine strains. Further analysis of the samples including genetic and antigenic characterization is ongoing.

Key words: Foot-and-mouth disease, outbreak, Serotypes, seasonality, Tanzania

Sero-positivity of foot and mouth disease in cattle in Marsabit County, Kenya

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Introduction: Foot and Mouth Disease (FMD) is a highly contagious acute viral infection of cloven hoofed animals. There are 7 serotypes of FMD virus i.e. A, O, C, Asia type 1, South Africa Territories (SAT) 1, 2, and 3. FMD is characterized by vesicular lesions, erosions & ulcers in the mouth & inter-digital areas, muzzle, teats & coronary band. The objective of the study was to determine the sero-positivity of FMD in Cattle in Marsabit County.

Methodology: A retrospective review was conducted on laboratory records of FMD samples drawn from cattle. The samples were collected from all the four sub counties of Marsabit during a national cross sectional survey that was done in 2016. The sampling units were villages randomly selected from the 20 wards of Marsabit County. Data for each sample was recorded and entered in MS-Excel, which was used for data cleaning and descriptive statistical analysis. Overall sero-positivity was calculated as a proportion of positive samples of the total samples that were collected. Sero-positivity per sub-county was calculated as the number of positive samples in each sub-county over the total number of samples collected in the sub-county. The relationship between age, sex and FMD status was also determined.

Result: Overall sero-positivity was 65.1%. The sub-county distribution was as follows; Saku 65.3%, Moyale 60.4%, Laisamis 67.0% and Northhorr 85.7%. In the wards, seropositivity was; Marsabit central (10.6%), Golbo (7.6%), Butiye (5.7%), Kargi/South-Horr (5.5%, Karare/Songa (4.5%) and the rest (31.2%). The seropositivity for age groups was 1-4 years (8.4%), 4-7 years (56.5%), and 7-10 years (0.2%). The sero-positivity in females was 53.7% while that for males was 11.4%.

Conclusion: FMD seropositivity is very high in Marsabit and it is attributable to natural exposure to the virus which calls for concerted effort especially though vaccination to reduce the FMD burden

Key words: Foot and Mouth Disease, Cross-sectional survey, sero-positivity, proportions

Characterization of foot and mouth disease distribution in Kenya in the period 2016 – 2017

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Background: Foot and Mouth Disease (FMD) is a highly contagious acute viral disease, transmitted directly across cloven hoofed animals. It is endemic in Asia, Middle East and Africa, (Kenya). FMD is characterized by fever and vesicular eruptions in mouth and feet with morbidity of up to 100% and mortality between 5%-95% in the young animals. East Africa serotype A, O, 1 and 2 are more prevalent with serotype1 being more severe. We aimed to describe the distribution of FMD cases and serotypes, across counties and among different species.

Methods: We reviewed FMD case records from Veterinary Epidemiology and Economic Unit (DVS) in the Epi-collect database, across the counties. A case was defined as a record of any cloven-hoofed animal diagnosed with FMD, as a suspect or confirmed case in Epi-collect spreadsheet. Data was managed and analyzed using Ms Excel. Descriptive analysis was done with Epi Info 7 and Ms Excel.

Results: A total of 316 records were analyzed. Bovines accounted for 73% of the cases while and caprines had 16%, Swine, Equine, and Ovine accounted for the 11% of the cases. Makueni and Nakuru reported the highest cases 15% and 14% of cases respectively. 66% of the cases were diagnosed clinically, and 33% were diagnosed in the laboratory. Serotype A accounted for 93% of bovine cases. Serotype A was predominant of the five found in bovines, the greater portion of cases occurred in May.

Conclusion: In this study, bovines bore the greater burden of FMD with all the serotypes. Since diagnosis by clinical signs is predominant, the county government should sensitize the staff on sample collection for confirmed diagnosis in the laboratory in controlling FMD.Since FMD is not treatable but be controlled easily through serotype specific vaccination

Key words: Foot and Mouth Disease, Epi-collect, Bovine, Serotype

Epidemiological analysis of passive surveillance data on foot and mouth disease occurrence in Nakuru county, Kenya

Dickson Machira

Introduction: Epidemiological analysis of passive surveillance data of animal diseases holds great potential in uncovering disease trends both temporally and spatially and flaws if any on the passive surveillance mechanisms in place. A study was conducted to investigate FMD occurrence in a county in Kenya.

Methodology: Data from the laboratory analysis of 171 samples was obtained from the National Foot and Mouth Disease (FMD) laboratory. This data was from samples submitted from Nakuru County for the period 2010 – 2016. The samples were self-submitted by community animal health workers and farmers as well as from outbreak response teams.

Results: A total of 107/171 (69.3%) of the samples were positive for FMDV with outbreaks occurring every year under study. Four serotypes (A, O, SAT -1 and SAT-2) were isolated with outbreaks of different serotypes occurring simultaneously. There was weak evidence of seasonality with the highest relative risk of sample submission being observed in March (4.75; 2.84–7.92, 95% CI) and September (6.5; 3.91–10.80, 95% CI), the final months of the dry seasons. Sample positivity did not show seasonal variation. However, there was significantly more sample collection during the dry season than in the wet season (p=0.02).

Conclusion: FMD is still a major concern in Nakuru County with different serotypes in circulation. The reason for seasonality should be investigated including effect of livestock movements in FMD outbreaks in Kenya. Passive surveillance data is useful in determining temporal patterns in disease occurrence. However intermittent active surveillance during off seasons might help reduce sampling bias.

Key Words: FMD, Passive Surveillance, Nakuru, Epidemiology, Regression

Trends in foot and mouth disease outbreaks and associated impact on control strategies in Kenya

Benson Kibore

Background: Outbreaks of Foot and mouth disease (FMD), which affects species of the order Artiodactyla, continue to be reported despite the application of control strategies as indicated in the national FMD control strategy. The outbreaks have been shown to affect more the Smallholder farmers estimated to produce over 70% of the national milk supply. The serotype O vaccine strain is based on an EA-1 topotype strain.

Objective: To understand the factors contributing to increased outbreaks of foot and mouth disease.

Methods: The vaccine matching (r1 values) to measure the antigen similarity between the field isolate and vaccine strain by comparing the cross reactivity of a vaccinal (reference) serum against field isolates and vaccine virus was undertaken (OIE Terrestrial Manual, 2009) and interpreted as per (Kitching*et al.*, 1988)

$$r1 = \frac{\text{titre of reference serum against field virus}}{\text{titre of reference serum against vaccine virus}}$$

Results: The results indicated a poor match between Serotype O vaccine strain and the field isolate.

Conclusion: The recent outbreaks have been demonstrated to be due to incursion of a new Serotype O strain. There is need to improve the modelling of assorting strains as a predictor so as to enable timely production of protective FMD vaccines.

Insights into the epidemiology of foot-and-mouth disease virus in rangelands shared by African buffalo and cattle in Laikipia County, Kenya

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Foot-and-Mouth disease (FMD) is a highly contagious wildlife and livestock disease compromising livestock and related products trade and conservation efforts due to the perception that wildlife, especially buffalo, are responsible for its introduction into domestic herds. Despite extensive studies in southern Africa, in eastern Africa the role of buffalo as the primary reservoir of FMD has not been fully expounded. This is especially critical as land-use systems in eastern Africa, are characterized by spatial segregation of wildlife and livestock. The objective of this study was to characterize the frequency and directionality of FMD virus between cattle and buffalo in central Kenya.

To characterize the frequency of buffalo-cattle FMD virus transmission, we collected blood and oropharyngeal samples from 92 buffalo and 98 cattle from Ol Pejeta Conservancy and adjacent community livestock in Laikipia County in January 2016. Sero-reactivity against FMD virus was measured by Nonstructural proteins enzyme linked immunosorbent assay (NSP-ELISA) while oropharyngeal (probang) samples were analyzed buy genetic sequencing of VP1 region. In addition, twenty one samples collected during FMD outbreaks in central Kenya, were also analyzed.

All cattle farmers reported a history of FMD clinical outbreaks in the recent past; with a high prevalence from NSP-ELISA of 93% (95% CI: 87-99%). Seroprevalence in buffalo was 77% (95% CI: 66-85%). This study recovered 16 sequences from cattle (serotypes A, O), and 75 sequences from buffalo (SAT1 and SAT2). Using Next Generation DNA sequencing, we found that six buffalo had dual infections by both SAT1 and SAT2. In addition, though buffalo and cattle in the study area have been shown to be highly mixing, we did not find SAT1 or SAT2 in cattle populations; suggesting that cross-species transmission events might be rare. Further, our results show that SAT1 and SAT2 found in buffalo are phylogenetically closely related to outbreaks elsewhere in Kenya, suggesting that though viral populations in cattle and buffalo are intermixed, buffalo may not be the source of infection to cattle.

Our results show that the direction of transmission from cattle to buffalo may be more prevalent than the reverse. Further, though some viruses in cattle and buffalo were similar, they both were genetically distinct from the current vaccine strains, suggesting a mismatch hence potentially a lack of efficacy. Our results significantly shed new insights in to the epidemiology of FMD virus in sympatric livestock-wildlife populations, and may guide control strategies in the region.

Key words: Wildlife-Livestock interfaces, Molecular epidemiology, Foot-and-Mouth Disease, Phylogenetics.

Market performance and the risk of spread of foot and mouth disease through cattle marketing activities in western Kenya

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There was an increase in number of outbreaks for Foot and Mouth disease (FMD) in western Kenya between the years 2014 and 2016, and cattle markets were believed to play a major role in maintenance and spread of FMD virus. A qualitative risk assessment was done to investigate the role played by cattle markets in the outbreaks and the specific objectives were to describe cattle marketing activities and practices that posed a risk for spread of FMD, conducting risk assessment for spread of FMD through cattle marketing activities and analysis of structure and performance of selected cattle markets within the region. Risk assessment was based on the framework adapted by World Organization for Animal Health: release assessment, exposure assessment and consequence assessment. A cross-sectional study was conducted in selected livestock markets of western Kenya to collect both qualitative and quantitative data using a semi-structured questionnaire. Additional data was obtained through focus group discussions with livestock traders while secondary data were obtained through review of published literature. Quantitative data were analyzed using descriptive statistical measures and Gini coefficients were also calculated to estimate cattle market concentration indices, while Lorenz curve were drawn to estimate cattle traders proportional market shares. Additionally, gross marketing margins were calculated to evaluate marketing performance in the region. The release assessment for FMD virus was determined by risk of FMD infected cattle moving through livestock markets, ability of the virus to survive in environment, and number of cattle traded in selected livestock markets. The exposure to FMD infections was determined through analysis of risk of FMD infected cattle getting into contact with susceptible ones, risk of cattle from livestock markets being quarantined and risk of spread within connected farms. These cattle markets had an oligopolistic market structure characterized by only a few livestock traders controlling trading business in cattle. Approximately 80% of cattle traders in one market controlled only 58% of the market shares, with the remainder of 42% market share being controlled by only 20% of the livestock traders. These livestock markets had an estimated Gini coefficient of 0.65 indicating a higher degree of concentration. Risk of release and exposure to FMD virus were presented by absence of veterinary officials in markets, trading on non-vaccinated cattle, cattle movement without permits, trekking cattle for long distances, lack of isolation of traded cattle at farms and visiting of many livestock markets within short period. The main strains which were circulating in the region included SAT 1 and serotype O strains. These findings call for increased support for FMD surveillance activities within cattle markets by the stakeholders involved in livestock disease control to protect farms which are connected to these farms.

Characterization of reported Lumpy Skin Disease cases in cattle in Kenya, for the period 2015-2017

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Background: Lumpy skin disease is an infectious eruptive and occasionally fatal viral skin disease of bovine with a morbidity of 10%-15% and a mortality of less than 5%. The condition is debilitating in nature and leads to production losses (decreased milk yield, and damage to hides). Reported outbreaks of lumpy skin disease are often sporadic and control of the disease is mainly through vaccination.

Objective(s): This study is aimed at characterizing lumpy skin disease trends, modes of diagnosis and intervention strategies employed by animal health technicians.

Methods: This study is a retrospective review of records of lumpy skin disease cases reported through the passive surveillance system to the veterinary and economics unit, DVS, for the period 2015-2017. Data was abstracted from the surveillance database onto an MS Excel template in a line list format, cleaned and analyzed using Ms. Excel. Categorical variables were analyzed and presented as proportions or frequency distribution tables while while disease trends were presented using line graphs.

Result: Atotal of 167 records were analyzed across the country. Majority of the cases were diagnosed clinically 161(97%) with a CFR of 4.7%. Lamu County reported the highest frequency of cases (15%)while BaringoCounty reported the least (1%). The highest proportion of cases was reported from mixed and extensive production systems. Vaccinations and quarantine constituted the highest proportion of interventions at24% and 21% respectively. On the other hand, inaction constituted 49(30%).The national vaccination coverage was 30%.The trends in LSD cases indicated variations over the study period.

Conclusion: More than 50% of the counties reported LSD over the 2 year period. Therefore, there is an urgent need to evaluate the disease control strategies and capacity of the affected counties to control the disease.

Key words: LSD, Kenya

Good distribution practices (GDP) for veterinary medicines and implications of non- compliance

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Veterinary Medicines play a critical role in the management, prevention and treatment of animal diseases and therefore, their quality and purity must be maintained throughout the distribution/supply chain system. The Veterinary Medicine Directorate (VMD) has been established to regulate the manufacture, importation, exportation, distribution, prescription and dispensing of Veterinary medicines and the practice of Veterinary Pharmacy, which enhances the Veterinary Professionals legal mandate and key role in ensuring that Veterinary medicines are properly managed from the source to the final end user in a manner that maintains the quality, efficacy, purity and safety of the Medicine in compliance with Good Distribution Practices (GDP). Distribution is an important activity in the intergrated supply-chain management of pharmaceutical products that must be properly controlled and monitored. Veterinary Professionals and the Regulators must understand the principals that underline Good Manufacturing Practices (GMP), Good Distribution Practices (GDP), Good Storage Practices (GSP) etc in order to safeguard the quality of medicines. Non-Compliance of GDP results in deterioration of products quality during the distribution chain which could lead to antimicrobial resistance and treatment failure.

Antimicrobial susceptibility patterns of *Staphylococcus aureus* in milk samples submitted at regional veterinary investigation laboratory Karatina, 2015 – 2017

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Antimicrobial susceptibility testing (AST) is used to detect antibiotic resistance in common pathogens and to determine the drug of choice for treating particular infections. Susceptibility of bacteria by disc diffusion methods is shown by a zone of bacterial inhibition in a plate containing a particular antibiotic. Lack of or reduced susceptibility of zoonotic bacteria to drugs is of great public health concern. Regional Veterinary Investigation Laboratory Karatina, is mandated to carry out laboratory diagnosis of animal diseases in Mt. Kenya and upper Eastern regions. The Laboratory receives many milk samples for culture and antimicrobial susceptibility testing.

The milk samples submitted by various stakeholders were analyzed in terms of number, County of origin and the antibiotic susceptibility results. In this review, we focused on the samples from which *Staphylococcus aureus* was isolated. Samples which had *Staphylococcus aureus* isolated were analyzed for drug susceptibility patterns against the following drugs: Kanamycin, Gentamycin, Ampicillin, Tetracycline, Streptomycin, Cotrimoxazole, Sulphamethoxazole and Chloramphenicol. An isolate that showed inhibited growth in presence of only 3 or less of the test drugs was considered

to be less susceptible. A total of 5186 samples of milk for culture and AST from Nyeri, Kirinyaga, Embu, Murang'a, Laikipia, Meru, Tharaka Nithi and Machakos Counties were received and analyzed in 2015 to 2017. 3200 these samples (62%) were from Nyeri County. 356 out of the total 5186(7%), had *Staphylococcus aureu s*isolated as the causative organism. 85 isolates(24%) of all *Staphylococcus aureus* showed susceptibility to 3 or less of the commonly used drugs. Reduced susceptibility of *Staphylococcus aureus* increased from 16% in 2016 to 30% in 2017.

The reduced susceptibility of *Staphylococcus aureus* to commonly used antimicrobials is of great concern in Mt. Kenya region. An active surveillance program is recommended to determine antimicrobial susceptibility of zoonotic bacteria in the region.

Key words: Antimicrobial Susceptibility, Passive Surveillance, Staphylococcus aureus

One health coordination platforms: Need to think beyond zoonoses to accommodate antimicrobial resistance and other relevant issues

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Antimicrobial resistance (AMR) remains a global public health threat at the human-animal-environment interface. In agriculture, antimicrobials are primarily used in terrestrial and aquatic animals production for both therapeutic and non-therapeutic purposes, and to a lesser extent, antimicrobial substances are spread on crops. Globally, approximately 70% of antimicrobials are used in animal agriculture, and about 30% in public health. Antibiotic-resistant bacteria of animal origin have been observed in the environment implying that there could be implications on environmental health. Addressing AMR requires One Health (OH) approach as in cross-sectoral, multi-disciplinary collaborations from the public health, animal production and health, fisheries, crops and other relevant stakeholders. By default, it would be expected that, already established national OH platforms would coordinate the sectors involved. However, in many countries, OH platforms have been institutionalized from a narrow focus of Zoonotic Disease Units (ZDU). A true OH platform would have the capability or space to address all OH issues in the country that include zoonotic diseases, aflatoxin, AMR, pesticide residues in food amongst others. Compared with zoonotic diseases which impact the environment- human-animal triad, AMR brings in a fourth component - plant health. Kenya like all other countries, embarked on developing a One Health-based National Action Plan (NAP) to combat AMR in 2015-2016. Guided by the World Health Assembly-endorsed Global Action Plan (GAP) on AMR and the Food and Agriculture Organization of the United Nations (FAO) Action Plan, 2016-2020, a consultative process to combat AMR brought together public health, food and agricultural sectors. Although the collaborations emphasize the OH approach, they were conducted outside the mainstream zoonoses focused -OH platform. The development of the OH NAP and policy documents was originally steered by the National Antimicrobial Stewardship Advisory Committee (NASAC) and a joint AMR technical working group (TWG). However the two structures were dominated by public health sector professionals while plant health, fisheries and environment sectors

were missing. To correct the anomaly an Agriculture sector working group on AMR (agAMR) was formed to improve participation of the agriculture sector in the policy process. Guided by NASAC and informed by a joint situational analysis, the public health stakeholders prepared the public health component of the NAP and Policy while the agAMR formulated the agriculture component. The two components were later merged in joint collaborations. While the multi-level collaborations ensured that no single sector led the process or treated the others as "invited sectors", the failure to have guidance from the national OH platform remained a concern. The AMR policy recommends that NASAC be reconstituted to reflect equal partnership of the sectors and to include the environmental sector that missed the NAP process. Lessons learnt from Kenya show that countries that have established OH platforms from the base of zoonotic diseases, may fail in the critical role of driving other OH issues like AMR. There is need to expand the scope of the zoonotic disease units to embrace AMR through multi and intra sectoral collaborations.

Overview of governmental support across Africa towards the development and growth of herbal medicine

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Traditional African Medicine (TAM) is our socio-economic and socio-cultural heritage, servicing over 80% of the populations in Africa. Although, it has come a long way from the times of our ancestors, not much significant progress on its development and utilization had taken place due to colonial suppression on one hand, foreign religions in particular, absolute lack of patriotism and political will of our Governments, and then on the other hand, the carefree attitudes of most African medical scientists of all categories. It is incontrovertible that TAM exhibits far more merits than demerits and its values can be exploited provided the Africans themselves can approach it with an open mind and scientific mentality. The degree of sensitization and mobilization by the World Health Organization (WHO) has encouraged some African countries to commence serious development on TAM. The gradual extinction of the forests and the inevitable disappearance of the aged Traditional Medical Practitioner should pose an impending deadline for us to learn, acquire and document our medical cultural endowment for the benefit of all Africans and indeed the entire mankind. There is a critical need to mainstream traditional medicine into public health care to achieve the objective of improved access to healthcare facilities. Increase of chronic diseases, awareness about limitation of modern medicine, proven efficacy of TCAM (Traditional Complementary and Alternative Medicine) systems in selected conditions, emerging interest in holistic preventive health, integrated approach to medical education and increasing awareness among physicians are some of the reasons for renewed interest in traditional medicine. We present the current situation in Africa in terms of government support on achievement of development of herbal medicine, its utilization, preservation and efforts of integration to convectional health care.

Keywords: Africa, Herbal Medicine, Government support, Traditional Medicine, Complementary Medicine, Alternative Medicine.

Pathogens isolated in mastitic milk and their antimicrobial resistance at the RVIL – Kericho, 2013 – 2016

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Background: Antimicrobial agents are used in humans, animals and plants for prevention and treatment of infectious diseases. Antimicrobial resistance(AMR) occurs when disease causing microorganisms such as bacteria, viruses, fungi and parasites are no longer responsive to previously

effective antimicrobial agents. Globally it is projected that by 2050, the health consequences and economic costs of AMR will be 10 million annual human fatalities and a 2 to 3.5 %decrease (equivalent to USD 100 trillion) in global Gross Domestic Product (GDP).The aim of the study was to identify the etiology of animal mastitis and determine the presence of and resistance pattern to antimicrobials in mastitis milk samples.

Methods: This was a retrospective review of data from records of mastitis cases presented at the RVIL – Kericho from January 2013 to December 2016. Case definition for mastitic milk was; change in milk color and consistency, clotted milk, milk clotting on boiling, blood in milk, a history of swollen udders and pain during milking. The offending micro-organisms were isolated on Blood and MacConkey agar and identified by colony morphology, Gram stain and biochemical tests.AMR was determined by Kirby-Bauer method, and resistance interpretation done as per the Clinical Laboratory Standards Institute's performance standards for antimicrobial testing. Data management (entry and cleaning) and analysis was done using MS Excel. We used descriptive statistics to summarize the data.

Results: 363 records were reviewed and nine genera of bacteria were isolated. Of these, 68% were *Staphylococcusspp*; 12% were *Escherichia coli*; 8% were *Klebsiella spp*; 7% were *Pseudomonas spp*;4.4 % were *Streptococcus spp*. Others accounted for 1.4%. Multidrugresistance was encountered in all isolated bacteria. Gentamycin was least resisted while sulphamethoxazole exhibited the most resistance of the drugs tested (ampicillin, tetracycline, gentamycin, streptomycin, Sulphamethoxazole, kanamycin, nalidixic acid, nitrofurantoin, cotrimoxazole and chloramphenicol.*Streptococcus spp*. showed the least resistance, while *Pseudomonas spp*. showed the highest resistance.

Conclusions: Antimicrobial resistance exists among mastitis causing bacteria. A study should be initiated to cover more areas/regions of the country. Animal health service providers should be sensitized on AMR trends.

Key words: Mastitis, Anti-microbial resistance, Staphylococcus, *Escherichia coli, Gentamycin, sulphamethoxazole*

Occurrence of animal bites and factors associated with delayed initiation and non-adherence to post-exposure prophylaxis for rabies, Uasin Gishu County, 2017

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Introduction: Animal bites incidence in Kenya is about 336/100,000 with an estimated 2000 human deaths from rabies annually. Rabies deaths continue to occur because of delayed Post-Exposure Prophylaxis (PEP) against rabies and non-adherence to prescribed PEP schedules by animal bite victims. We described the occurrence of animal bites, bite victims, and identified factors associated with delayed initiation and non-adherence to PEP for rabies in Uasin Gishu County.

Methods: We conducted a hospital-based cross-sectional study from May to July 2017 in Uasin Gishu County. In-person interviews using a structured questionnaire were done to collect data from participants. Outcomes of interest for PEP initiation were presence or absence of delay (>48 hours) while for PEP adherence was adherence or non-adherence to prescribed PEP schedules. Prevalence odds ratios (OR) at 95% confidence intervals (CI) were calculated and factors with p-value ≤ 0.05 considered significant.

Results: of the 250 bite victims interviewed, 133(53.2%) were males with the median age of 21 (Range 0.75-79 years). Of the bite victims, 95(38%) were children aged $\leq$ 15 years, 181(76.4%) resided in rural areas and 213 (85.2%)bitten by dogs. Median time from bite to seeking care was 2 days (Range 1-30 days) with 95(37.6%) initiating PEP late (>48 hours) and 104/233(44.6%) not adhering to the prescribed PEP schedules. Bite victims residing >20 km from the health facility were twice as likely to delay PEP initiation as those residing $\leq$ 20 km (OR=2, CI 1.16-3.47). Bite victims obtaining PEP at > Ksh 900 were twice as likely to fail to adhere to prescribed PEP (OR=2, CI 1.18-3.41) compared to those obtaining at $\leq$ Ksh 900.

Conclusion: Most bite victims were children and bitten by dogs. A considerable proportion of bite victims delay to initiate and adhere to PEP for rabies due to socio-economic and infrastructural barriers to accessibility.

Key words: Rabies, PEP, Adherence, Animal bites, Dogs

Suspected human cutaneous anthrax in Thika – Kenya

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Background: Anthrax is an endemic and notifiable disease in Kenya, prioritized as the most important zoonotic disease. The Disease Surveillance and Response Unit (DSRU) and the ZDU were notified of suspected human anthrax cases admitted at Thika County Referral Hospital (TCRH) on May 10, 2017. A multidisciplinary team from ZDU, FELTP and the One Health Program of the UoN were deployed to investigate the outbreak and develop a cases series report.
Methods: We determined the magnitude of the outbreak through case search and possible exposures through interviewing the admitted persons using a structured standard questionnaire; and discussions with the hospital medical personnel and the County director of Veterinary Services.We defined cases as an acute illness with painless skin lesion developing over 2 to 6 days. Lesions developed first as papules then vesicules and later into depressed black eschars with surrounding edema in a person of any age presenting to TCRH since May 1, 2017.

Results: The first admission to hospital was on May 6, 2017, five of the ill individuals were admitted on May 9, and the last one admitted on May 11. Four of the seven admitted (57%) developed symptoms on May 4 giving an approximate incubation period of five days. The disease was associated with contact with a slaughtered animal with eight out of 15 people who had contact with the slaughtered animals developing the symptoms (attack rate of 53%). The ill individuals were involved in slaughter and/or handling of the meat. All presented with visible cutaneous lesions of suspected anthrax with almost pathognomonic eschars.

Conclusion: We demonstrated a probable cutaneous human anthrax outbreak likely caused by exposure to meat from infected cattle carcasses. Our findings point to a common source exposure. We recommend strengthening of the quality control checks at the slaughterhouse to ensure all the workers follow standard operating procedures.

One health focus within the Kenya field epidemiology and laboratory training program, 2008-2017

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Background: Kenya Field Epidemiology and Laboratory Training Program (K-FELTP), has a long-standing record of undertaking One Health activities. We describe the contribution of the K-FELTP in One Health implementation and identify areas that would benefit from future development and expansion.

Methods: We reviewed K-FELTP activities relating to One Health or zoonotic issues such as participation in outbreak investigations and response and conduct of epidemiological studies.

Results: The K-FELTP has a three-tiered approach, training participants from Kenya and from other countries in the African Region. The three tiers include an advanced two-year Masters-level course, a 3-month basic "Frontline" epidemiology short-course, and a 6-month intermediate level course for graduates of the 3-month course. Participants are veterinarians and medical personnel, including medical officers, pharmacists, nurses, public health/surveillance officers, clinical officers, and laboratory staff. They are jointly trained in outbreak investigations, disease surveillance, and general field epidemiology. From 2004 to 2017, K-FELTP trained 209 advanced-level residents (181 medical personnel and 28 veterinarians). From 2014 to 2017, K-FELTP trained 548 Frontline participants (482 medical personnel and 66veterinarians). From 2015 to 2017, K-FELTP trained 95 Intermediate participants (80 medical personnel and 15 veterinarians). During 2014-2017, 12 advanced-level residents (3 medical and 9 veterinary) received K-FELTP training that focused on One Health, conducting epidemiological studies focused on zoonotic diseases (dengue/chikungunya, rabies, Middle Eastern Respiratory Syndrome Coronavirus, brucellosis, Q-fever and campylobacteriosis). Advanced-level residents evaluated various surveillance systems including Rift Valley fever (RVF), avian influenza, rabies and animal bites, brucellosis, and bovine tuberculosis, among others, and made recommendations to improve surveillance. Since 2014, residents have investigated 57 zoonotic or vector-borne public health events locally or regionally, including dengue fever, chikungunya, Marburg hemorrhagic fever, Ebola viral disease, Rift Valley fever, rabies, anthrax, and visceral Leishmaniasis, and some food-borne outbreaks, leading to timely implementation of prevention and control measures. Such investigations are jointly conducted by residents with veterinary and medical backgrounds. In addition, alumni of the program have formed an association where they continue to interact and share ideas. During 2014-2017, KFELTP residents presented 89 abstracts in scientific conferences and published 37 manuscripts. KFELTP was also instrumental in the formation of Kenya zoonotic disease unit (ZDU) which is staffed with medical and veterinary advanced-level graduates.

Conclusions: Joint training of medical and veterinary professionals byK-FELTP has strengthened collaboration between the human and animal sectors and established collaborative networks among graduates that promote a One Health approach. Further increasing the number of veterinary and medical residents and expanding opportunities on One Health could improve efforts for control and prevention of zoonotic diseases.

Key words: One Health, Kenya

Assessment of rabies situation in five informal settlements of Nairobi, 2017

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Introduction: In Kenya, rabies has been endemic since it was first reported in 1912 in a dog and in a human being in 1928 (ZDU 2014). Though human rabies is periodically reported, the number reported is very low and not a true reflection of the real picture of the disease in the population.In Nairobi County, and especially in the informal settlements, little efforts have been undertaken to control rabies unlike in the rest of the formal settlements where dog owners take their animals for annual rabies vaccination. An assessment in five informal settlements (Kawangware, Kangemi, Kibera, Mathare/Viwandani and Mukuru/Korogocho) was carried out to obtain indicative data for the dogs population, artuculate the understanding of the population on dangers of rabies and determine the dog population vaccinated against rabies.

Methodology: Field visits to these areas were made to collect primary information/data and interviewing key informants involved in the control of rabies in Kenya. The consultant administered a set of questionnaires, held focused group discussions, interviewed key informants and made own observations to collect both qualitative and quantitative data. The data/information collected was cleaned, collated and analysed using Microsoft Excel. Primary data collected was triangulated and verified through the relevant public offices and other partners working in these informal settlements.

Results: A total of 251 household heads were interviewed in the randomly selected houses within the five informal settlements. Kawangware had the highest number 80% (40/50) of families owning dogs. The main use of dogs in the informal settlements is security. Very few households keep the dogs for companion as pets (3%) or for breeding purposes. There is a low vaccination level of dogs in the informal settlements; only 11% of the dogs were vaccinated against rabies, unlike in formal settlements where studies have shown over 90% vaccination levels. Nearly all the respondents had heard about rabies disease either through formal or informal channels and most are aware that the disease is transmitted through dog bites. Only 7% of the respondents knew a patient who had died of rabies.

Conclusion: There is high community awareness on rabies. Almost all cases of dog bites in the community are reported to health facilities. More awareness needs to be created on the management of the disease including the mandatory 5 PEP injections to patients exposed to the disease. The study highlighted overall poor disease knowledge by medical doctors, severe under-reporting of human rabies cases, lack of record keeping and poor collaboration between the medical practitioners, animal health actors and communities in rabies control. Developing programs that will increase awareness on importance of this disease to the community including the school children is recommended. Annual vaccination programmes that are in line with the Strategic Plan for Rabies Control and Elimination in Kenya should be developed for the informal settlements

Key words:Rabies, informal settlements, vaccination

Epidemiology and surveillance of human animal-bite injuries and rabies post-exposure prophylaxis, in selected counties in Kenya, 2011 – 2016

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Background: Human animal-bite injuries are serious public health problemsfrom associated risk of exposure to rabies virus; thus useful indicators for rabies virus transmission and rabies post exposure prophylaxis (PEP) needs. Understanding the epidemiology of human animal-bite injuries and PEP is critical inimplementing Kenya's rabies elimination strategy. We aimed to describe the patient, biting animal characteristics, uptake of PEP and factors associated with humananimal-bite injuries.

Methods: We reviewed human animal-bite injury records in 17 health facilities from five counties. Acase was described as a record of a bitefrom amammalian animal including humans,in a person of any age from 2011 to 2016. Demographic and PEP uptake information werecollected. Descriptive statistics, odds ratios (OR) and 95% confidence interval (CI) using age-group (<15/>15 years) as the independent variable and sex, biting animal and PEP uptakeas dependent variables and population adjusted incidence were calculated.

Results: We analyzed 7,307 records. Median age was 22 (IQR=31) years; males were 4,019 (55%) and < 15 years were 2,607 (37%). Dogs accounted for 93% (6720/7,270) of bites with 78% being owned dogs. Rabies PEP was given to 5,674 (88%), with 2,247 (39.7%) getting at least three-doses.

Median time from bite to seeking medical care was 2 (IQR=4) days. Children <15 years were 5.7 (95% CI 3.3, 10.2) more likely to have bites on the head/face and 1.7 (95% CI 1.5, 1.9) as likely to be bitten by owned dog. Population adjusted incidence was 289 per 100,000 persons. Population adjusted incidence was higher in males and in<15year olds in Kitui, Machakos and Nandi counties.

Conclusion: Vaccination of owned dogs and public education with emphasis on children <15 years will significantly contribute towards rabies elimination. Integrated bite case management could significantly improve PEP initiation and completion as well as reduce use of PEP among non-rabies exposures.

Key words: Rabies, epidemiology, post-exposure prophylaxis, surveillance

Comparative assessment of hatching rates of African catfish (Clarias gariepinus) eggs using Nile cabbage and Kaka bans substrates

Dr. Felix Matura Kibegwa

The African Catfish (*Clarias gariepinus*) species, market demand, has risen over the years. This escalating demand is not only for stocking of ponds but also its use as bait fish in capture fisheries. This demand has been widely attributed not only to their ability to tolerate a broad range of environmental parameters but also their high reproductive potential and rapid growth. Due to the unreliable nature of seed collection from wild and its limitation to the rainy season, hatchery seed production has opted. However, artificial hutching is faced by a number of problems key among them which substrate to use incubation of catfish fry. The commonly and locally used substrates are Kaka bans (artificial) and Nile cabbages (*Pistia stratiotes*) (natural). This study was meant to compare hatching rates between these commonly used, locally available low-cost substrates and to establish if the difference is significant. The study was carried out at Sagana Fish Culture Farm where there is a modern hatchery, and both substrates are readily available. The experiment was a conducted as a random block arrangement of three treatments (incubation substrates); KB: Kaka bans (artificial substrate), NC: Nile cabbage (natural substrate) and TI Tray-type of incubator (control), with two replications.

Four ready to spawn, mature brood stock were used in a ratio of 1:1(male to female). After an acclimatization period of one day without feeding, all females were injected intramuscularly into the dorsal muscle 0.2ml per a kg of a synthetic gonadotropin hormone, Ovaprim®. After 12 hours, the females were stripped off ripe eggs while milt was obtained by sacrificing the males. An equal volume of clean water was then added to activate the sperms. Number of eggs in 0.01gram of eggs were counted under a microscope then used to calculate the weight equivalent to 500 eggs. The fertilized eggs were spread evenly on the substrates in bunches of 500 eggs per substrate. Throughout the experiment period, the Water temperature was maintained at 28.0 ± 1°C, Dissolved Oxygen (DO) at 6.0 ± 0.3 Mgl^{-1}, pH at 7.9 ± 0.4 and conductivity at 236 ± 15 µs.

After a latency period of 22 hours, the substrates were removed to obtain the hatchlings. The live hatchlings were then counted, separated from the dead shells and transferred to another incubation tank for weaning. The resulting hatching rates were subjected to Analysis of Variance (ANOVA) procedure using the package Genstat software (Genstat, 13th edition) for Windows to assess for any differences using the Duncan's Multiple Range Test. The cost of using each of the hatching substrates was also assessed by accounting for all expenses incurred for each of the methods evaluated.

Nile Cabbage ranked best in performance with a mean hatching rate of 51.4% (256 hatchlings), trays were second with a mean rate of 23% (115 hatchlings), while kaka ban mats were last with an average of 13% (65 hatchlings). There were minimal differences in costs incurred in the use of all three substrates in this experiment.

In conclusion, Nile cabbages showed the best hatching rates among the three substrates. Given the minimal cost attributed to these three substrares, we recommend using the Nile cabbages as incubation substrates in artificial propagation of catfish

Key words: catfish farming, fish eggs, Kenya

Overview of farmed fish parasites in central Kenya with emphasis on importance and control

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Farmed and wild fish are known to be hosts to parasites which include the phyla Protozoa, Platyhelminthes, Nematoda, Acanthocephala, Arthropoda and Annelida. The number of parasites necessary to cause harm to fish varies considerably with fish species, size and health status. Intensive fish farming encourages propagation of parasites and can result in serious outbreaks.

Cross-sectional studies were conducted between August 2014 and December 2017to determine the occurrence of ecto- and endo-parasites of farmed fish in Kiambu, Kirinyaga and Nyeri counties of central Kenya. A total of 1,361 live fish samples comprising of 984 (70.6%) tilapia (*Oreochromis niloticus*), 197 (14.2%) catfish (*Clarias gariepinus*), and 180 (12.9%) and rainbow trout (*Oncorhynchus mykiss*) fish were purchased from farmers in the study counties. Eyes, skins, gills, muscles, stomachs and intestines of the fish were examined for parasites using dissecting and compound microscopes.

Tilapia was the main species farmed under semi intensive system in earthen ponds while catfish were mainly reared in liner ponds. Rainbow trout were farmed intensively in concrete ponds and iron-sheet vats. Earthen pond fish had higher parasite infestation than those from liner and concrete ponds. Ectoparasites found included monogenean trematodes, *Dactylogyrus* spp. which were recovered from the gills of tilapia, and catfish while *Gyrodactylus* spp. were found on the skin of tilapia and catfish. The ciliate, *Trichodina* spp. was recovered from the skin of tilapia, catfish and rainbow trout. Leeches (*Pisciola* spp.) were found attached on the gills and skin of tilapia from Nyeri County. Endoparasites recovered were digenean trematodes, *Diplostomum* spp. in the eyes of tilapia and catfish whereas C*linostomum* spp. was found in the muscles of tilapia. Nematodes recovered included: larval stage three (L_3) of *Contracaecum* spp. in the abdominal cavity of catfish and adult *Paracamallanus* spp. in the intestines of tilapia and catfish. *Acanthocephalus* spp. was recovered from the intestines of tilapia, catfish and gold fish. A cyclophyllidean cestode was found in the intestines of tilapia and catfish from Kirinyaga County.

The parasites reported in this study affect the health and quality of fish leading to condemnation at inspection and heavy infestations may cause mortality and decreased profit margins at farm level. Helminths (Cestoda, Trematoda, Nematoda) that have larval stages (plerocercoids, metacercaria, L_3) in freshwater fish are potentially zoonotic if eaten raw or partially cooked.

Chemical treatment of fish against ectoparasites using formalin (Formalin-F®, Paracide-F®) bath is recommended whereas treatment of helminths using praziquantel, albendazole or levamisole has been indicated. Proper cooking of fish and deep freezing at -20^{0}C has been recommended to avoid risks of transmission of fish parasites to humans. Regulations that govern fish movement from breeders to rearing farms and international trade should be enforced so that only clean fish stocks are moved.

Keywords: Catfish, farmed fish, parasites, pond, tilapia, zoonosis

NB: Use of formalin in low concentrations has been approved by the US FDA

Preliminary findings of common bacterial pathogens affecting farmed fish in Kirinyaga county, Kenya

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Some bacteria associated with fish are ubiquitous in aquatic environments but can potentially cause fish disease(s) especially under stressful intensive farming conditions. The disease(s) may cause mortality, increased production cycletime and thus limit fish production. A study was carried out between December 2017 and March 2018 to investigate common bacterial pathogens of fish in small scale breeder and grow-out fish farms in three sub-counties of Kirinyaga County, Kenya. A total of 106 live fish [43 tilapia (*Oreochromis niloticus)*, 34 catfish (*Clarias gariepinus)* 23 goldfish (*Carassius auratus*), and 6 koi carp (*Cyprinus carpio carpio*)] were purchasedfrom randomly selected fish farms in the study area. Skin and kidney swabs; gills and a portion of intestines were collected aseptically from each fish for bacteriological isolation using standard bacteriological protocols.

Isolated bacteria were characterized using colony morphology, Gram staining and biochemical tests. Ninety-nine (99) bacterial isolates were recovered. The Gram negatives comprised genera: *Proteus*(51%, n=50),*Aeromonas* (28%, n=28), *Pseudomonas* (10%, n=10), *Citrobacter* (3%, n=3), *Flavobacterium columnare* (3%, n=3), *Salmonella*(1%, n=1), and *Enterobacter* (1%, n=1); while Gram positives comprised genera *Bacillus* (2%, n=2)and *Streptococcus* (1%, n=1). *Aeromonas*, *Proteus* and *Pseudomonas* organisms were all isolated from all the four fish species studied. *Flavobacterium columnare* was isolated from tilapia and goldfish. *Salmonella* and *Bacillus* organisms were isolated from catfish and tilapia. *Citrobacter* was isolated from goldfish and catfish while *Streptococcus* was isolated from tilapia only. S*almonella*, *Bacillus* and *Streptococcus* organisms were only isolated from fish samples from grow-out farms while *Enterobacter* organisms were only isolated from breeder farms. All the bacterial species isolated were found on the skin and gills; and in the intestines, which means that they are present in the farmed fish aquatic environments. Organisms of the genera *Proteus, Aeromonas, Flavobacterium columnare* and *Enterobacter* were also recovered from the kidney indicating infection after overcoming the fish defense mechanisms. *Aeromonas, Salmonella* and *Streptococcus* do not normally cause clinical disease in fish; however they can cause severe illness in humans.Thus in addition to these bacteria being potentially pathogenic to fish, with subsequent reduction infish productivity, they are a public health hazard. Improvement of husbandry practices and biosecurity at farm level are, therefore, recommended. There is need to undertake more research on use of vaccines and/orprobiotics whose effectiveness in improving water quality, immunity, health status, feed conversion efficiency and growth performance of farmed fish has been reported.

Keywords: Fish production, Bacterial pathogen, Public health

Heavy *Neascus* species infestation of farmed *Oreochromis niloticus* in Kirinyaga county, Kenya

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Black spot disease is common in freshwater fish and is usually caused by metacercariae of a digenean trematode, *Neascus* spp. in the Diplostomidae family. This disease was first encountered in December 2017 in a grow-out *Oreochromisniloticus* (tilapia) farm with a single liner pond in Kirinyaga Central sub-county, Kirinyaga County. Two (2) mm sized black spots were found in various organs of 10 sampled fish on parasitological examination. However, in a neighbouring farm (<1km away), tilapia in a liner pond were negative for this condition. Risk factors of the disease were assessed through semi-structured questionnaire interview and researchers' observations of the pond and its environs. A re-sampling of the farm was conducted in January 2018, where 45 tilapia were collected to determine distribution and intensity of lesions. The black spots from diseased fish were counted on the left side of the fish and multiplied by 2 to determine the intensity.

All the sampled tilapia had black spots lesions and percentage distribution in various organs was as follows; fins (43.9%), skin and muscles (23.9%), operculum (8.8%), eyes (2.8%), inside the mouth (2.6%) and gills (1.8%). A mean intensity of 728was recorded and females had higher intensity compared to male fish ($p<0.05$). Correlation between condition factor and intensity was not statistically significant ($p>0.05$).

Among the risk factors of the disease noted within the farm were presence of snails and piscivorous birds which propagate the life cycle of the parasites. Vegetation such as banana stems which were very close to the ponds were noted to be hiding places for these snails. The dam-liner and the poorly constructed dykes were pervious and this could also pose a risk especially during the rainy season. Black spot disease has an indirect implication on the economic value of fish as those infested are rejected at market level due to aesthetic reasons leading to economic losses. Recommended control measures include use of cover nets over the ponds to prevent interaction of predatory birds which are definitive hosts of digeanean trematodes of fish and farming crops such as bananas which harbour snail intermediate hosts in close proximity to fish ponds should be discouraged.

Key words: Black spot disease, *Neascus* spp.metacercariae, predator birds

The pathogens affecting the health of the domesticated honey bees, *Apismellifera* in Kenya

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In Kenya, honeybees (*Apismellifera*) are considered as emerging livestock and can be easily domesticated using various hive technologies. The main products of honeybees include honey and beeswax, which are a major source of income and livelihood. Bees also play a major role in food security through its pollination services. The honeybee in Kenya is affected by parasites, pests, viruses, fungus, and bacteria worldwide. Varroa mite, which is the major parasitic mite attacking bees

the world over, is a vector of most bee viruses and other bee pathogens. The bee viruses of economic importance are single-stranded RNA Picornaviruses, falling under the families, Disistroviridae and Iflaviridae. In Africa, five honeybee viruses have been reported which include Acute Bee Paralysis Virus (ABPV), Israel Acute Paralysis Virus (IAPV), Sacbrood Virus (SBV), Black Queen Cell Virus (BQCV) and Deformed Wing Virus (DWV). Reports indicates that bees in Africa seem to be less affected by the viruses, but with the continued spread of varroa mites in Kenya, the scenario would be reversed.

This study aimed at identifying the possible presence of other pathogens affecting honeybees in the country, besides the reported ones, using next generation sequencing. Samples of adult and immature bees were collected from eight sites. RNA was extracted, pooled per site and subjected to 454 pyro-sequencing. A bacterial disease,European foulbrood and IflavirusVarroa destructor virus type 1 and Kakugo virus, which had not been earlier reported were detected. There is need for the Country to adopt a standard protocol for continuous monitoring of bee diseases, for timely intervention and ease of trade, since some of the honeybee parasites and diseases are trade sensitive and listed by OIE as notifiable requiring urgent attention.

Keywords: Honeybees, pathogens, Varroa destructor, next generation sequencing, RNA

Posters

An electronic syndromic surveillance system for early detection and control of livestock diseases in Marsabit County, Kenya

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Introduction: Infectious diseases cause substantial losses on livestock production and trade, particularly in pastoral areas where livestock husbandry is the main socioeconomic activity. Some of these diseases are zoonotic and hence their occurrence have additional consequences on human health and wellbeing. Surveillance data should inform intervention measures but sometimes the long turn-around time used for processing some of these data limit their timeliness and utility. Syndromic surveillance systems are therefore being used more for early detection and response since they can identify clusters of cases before definitive diagnoses can be made. We implemented an electronic syndromic surveillance system in Marsabit County, Kenya as part of the animal health and production interventions in the area.

Materials and methods: For field data, veterinarians collect data via telephone contacts with community disease reporters (CDR) who are based at the village and have been trained on disease recognition. The data are posted to an on-line server at the end of each day or as soon as it is recorded in data collection tool (ODK – Collect).

Analyses: The server has an automated script that processes and analyses the data as it receives and generates trends in syndromes or diseases in tables, maps or graphs which can be used by the County veterinarians to inform targeting of response interventions in space and time.

Results and discussion: Syndromes reported in the field included foot and mouth lesions, diarrhea, respiratory syndrome and a few sudden death events. Suspected conditions associated with the syndromes included Peste des Petits ruminants in sheep and goats, pneumonia, and Foot and Mouth Disease in cattle among others.

Conclusion: The syndromic surveillance system is the most appropriate system for early detection and response to livestock diseases.

Key words: Syndromic surveillance, mobile networks, participatory disease search, community disease reporters

Assessment of knowledge, attitude and practices of anthrax among pastoralists in wajir, isiolo and Marsabit counties, Kenya

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Anthrax is an important zoonotic disease in Kenya causing high morbidity and mortality in both human and livestock. It is endemic in the Country.

The objective of this study was to assess the Knowledge, Attitude and Practices (KAPS) of anthrax among pastoralists in Wajir, Isiolo and Marsabit. The study was cross-sectional whereby various areas of anthrax outbreaks were identified through the veterinary departments in the three study Counties of Wajir, Isiolo and Marsabit. These areas were visited and using systematic sampling methods, a total of 400 households were visited. Data were collected through questionnaires administered via personal interviews. Information collected included demographic characteristics of the households, knowledge on anthrax, attitude and practices on the disease.

Pastoralists had adequate knowledge on anthrax. They correctly pointed out the clinical signs of anthrax in livestock such as sudden death, bleeding from body orifices and cutanous sores. The indigenous knowledge was uniform in all the three Counties. Despite that knowledge, they reportedly engaged in dangerous practices that would expose them to infection by anthrax. These practices included consumption of meat from suspect anthrax cases, opening of carcasses of dead animals, and throwing of anthrax suspect carcasses in bushes.

Anthrax is a well known disease in this pastoral setting. There is a need for education programmes to be designed for this community especially with regard to proper handling of suspect anthrax cases. Continuous anthrax efforts should be initiated through vaccination of livestock.

Application of snake venom in formal veterinary practice in Eastern and Southern Africa

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Snake venom has for centuries; been used in traditional medicine for different ailments in man and animals. However, it use has continued to gain more acceptance in conventional medicine over the past century in many parts of the world. A qualitative cross-sectional study was carried out to document the knowledge, attitudes and practice on application of snake venom in formal veterinary practice in eastern and Southern Africa. Twenty three (23) veterinarians and related professionals in Kenya, South Africa, Zimbabwe and Uganda were surveyed, between August 2017 and February 2018.All the respondents were familiar with snake venom being used in antivenin production; 74% (17/23) were familiar with its use in coagulopathy; 22% (5/23) were familiar with its use in chemotherapy. Twenty two percent (5/23)of the respondents were aware of the application of snake venom in dermatology; 17% (4/23) familiar with its use in anaesthesia and another 17% (4/23) its use in neuropathology. Of the 23 respondents, 17 (74%) had an idea of the species of snake from which the venom could be extracted and of that 17, 52% (9) thought that snake venom can be extracted from any poisonous snake species; 9% (2) thought venom could be extracted from mambas, vipers and cobras; 4% (1) thought venom could only be extracted from vipers. One respondent (4%) thought the venom can only be extracted from mambas while another one respondents did know from which snake species. All the respondents were willing to advocate on the uses of snake venom in medicine and 96% were willing to learn more about the uses. From the study, it was concluded that the respondents were mostly aware of the use of snake venom in antivenins but not so much with the other uses. However all respondents were willing to explore other application of snake venom in conventional practice but required more training and practice.

***Keywords**: Snake Venom, Knowledge Attitude & Practices, Alternative Veterinary Medicine*

Validation of enzyme linked immunoassay (Elisa) for diagnosis of camel brucellosis using latent class analysis;Kenya, 2017.

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Introduction: Brucellosis is a zoonotic infection caused by Gram negative bacilli of Brucella genus. Brucellosis can cause serious human disease, hazardous to laboratory personnel and ranked among first five priority zoonotic diseases in Kenya. Camels are highly susceptible to *B. abortus* and *B. melitensis* species. Culture and serology are used for diagnosis; however no diagnostic tests have been validated for camel brucellosis in Kenya. This study sought to validate ELISA using Bayesian latent class analysis.
Methods: We conducted a cross sectional study. Each camel sera sample was tested in parallel using ELISA and Rose Bengal Test (RBT). Two populations were defined by gender and test results cross-tabulated per each population. Using web based application at http///mice.tropmedres.ac, the two tests in two population model was used to estimate test characteristics and prevalence of brucellosis.
Results:A total of 374 camel sera samples were collected. Nine of 374 samples (2.4%) were inconclusive after repeat ELISA test and were excluded from analysis. Of the remaining, 62% (225/365) were females and 74% (269/365) were >4 years. The mean age was 7.4 years (SD±4.5 years). On Bayesian Latent Class Models(BLCMs) true prevalence of camel brucellosis in female camels were 29.9% (95% BCI;12.5-51.7)and in males was7.0% (95% BCI;0.2-25.7). Estimated

sensitivity was 91.7%(95% BCI; 61.2-100) for ELISA and 12.3%(95% BCI;5.0-33.4) for RBT. Specificity was 86.2%(95% BCI; 75.2-99.9) for ELISA and 99.8 % (95% BCI: 98.4-100) for RBT. Positive predictive value was 63.4% (95% BCI;26.1-99.8) for ELISA and 93.9%(95% BCI; 62.0-100) for RBT. Negative predictive value was 97.7 (95% BCI; 80.4-100) for ELISA and 80.8%(95% BCI;61.4-93.7) for RBT.
Conclusion:This study highlighted a high prevalence of brucellosis especially in female camels.ELISA had a high diagnostic accuracy and was recommended for use as a screening test for camel brucellosis.

Key words: Camel, Brucellosis, Latent class analysis

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The Higher Education Loans Board, HELB, is the leading financier of higher education in Kenya. It is a State Corporation under the then Ministry of Higher Education, Science and Technology. HELB was established by an Act of Parliament (Cap 213A) in 1995.The mandate of the Board is to disburse loans, bursaries and scholarship to students pursuing higher education in recognized institution. HELB provides affordable loans bursaries and scholarship to Kenyans pursuing higher education. Key among the responsibilities of the Board is sourcing funds, establishing, managing and awarding loans bursaries and scholarships to Kenyans pursuing higher education in recognized institutions. Through the Act, the Board has been able to recover funds loaned out to Kenyans in the past.

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We rescue individual animals, safeguard populations, and preserve habitat.

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in action around the world. Our network of specialists and scientists' worldwide stays attuned to the needs of each region by being on site, experiencing them first hand, and speaking with government officials, farmers, ranchers, and local authorities to learn their concerns and needs. Our innovative leadership affects more than agriculture. We're originators of countless ingredients that improve the health and lives of humans, their pets, and animals. Some of these innovations include new food technologies that keep edibles fresher and more flavorful, pharmaceutical dyes with colorants that are naturally derived, and nutraceuticals that maintain wellness, improve eye and cognitive health, aid weight loss, and enhance athletic power.

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KENYA ANIMAL GENETIC RESOURCES CENTRE (KAGRC)

The Kenya Animal Genetic Centre formally known as Central Artificial Insemination Station(CAIS) was established by Kenya Gazette Notice Number 557 of 19th June 1946 with the objective of controlling venereal diseases and genetic improvement of exotic dairy cattle. The current mandate of KAGRC is to produce, preserve and conserve animal genetic material(semen embryo, tissues and live animals) and rear breeding bulls for provision of high quality disease free semen to meet the national

demand for export. In order to meet its mandate, KAGRC works in close collaboration with other breeding organizations such as Kenya Stud Book, the Dairy Recording Services of Kenya and the Livestock Recording Center. Together, these organizations implement the Contract Mating and Progeny Testing Programmes. The organization also works closely with the breed societies as well as individual and institutional farms which provide herds for the breeding program.

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Started in 1999 as a result of major restructuring by the giant German Chemical and pharmaceutical company, Hoechst AG, HighChem Group is a conglomerate of companies operating within East Africa devoted to improve health and productivity in crop science, veterinary, home-care, human pharmaceuticals and hospital consumables plus diagnostic technologies through the best practices possible.

VISION- To be a regional centre for life science.

MISSION- To improve health and productivity in crop science, veterinary, homecare, human pharmaceuticals and hospital consumables plus diagnostic technologies through the best practices possible. The company is committed to the provision of quality products, on time product deliveries and quality services.

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Its mission is "Animal Health: to protect animals while benefiting mankind". In this capacity, Bayer Animal Health is among the leaders worldwide. It has attained this leadership position by continuously researching and developing products for animal health and pest control since 1919. A responsible relationship between humans, livestock and companion animals requires ensuring the health of animals. Bayer Animal Health protects millions of farm animals by offering effective, safe animal health care products. The role that companion animals such as dogs, cats and horses play as they accompany man through life is growing in significance. Keeping this relationship healthy is not just an obligation to man's animal companions; it also protects humans from the transmission of disease pathogens.

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Kenya Dairy Board is a statutory body established in 1958 through an Act of Parliament, the Dairy Industry Act, Cap 336 of the Laws of Kenya.

Mandate-To regulate, develop and promote the Dairy Industry in Kenya.

Vision statement-To be a global leader in Dairy Regulation and development.

Mission statement- to regulate and direct sustainable and competitive dairy industry that provides quality and safe products.

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KCB AGRIBUSINESS

KCB's overarching mission is to improve lives through better banking services thereby becoming the preferred financial services provider with a global reach. In this respect, the decision by the KCB Group to invest in the agricultural sector heralds its determination to make giant steps in delivering

this mission. In this regard, a partnership with MasterCard Foundation yielded MobiGrow, a program implemented in Kenya and Rwanda, with the aim of attaining results and innovations leading to higher productivity of farmers in various value chains and effective management practices by farmers' producer organizations.

The MobiGrow program seeks to resolve constraints in access to technical training and financial services for smallholder crop farmers, dairy producers and pastoralists.

The objectives of the program are:

i. Delivering a highly innovative and scalable digital financial ecosystem solution for rural smallholders and pastoralists called MobiGrow.

ii. Improving productivity amongst rural agro-entrepreneurs through facilitating quality extension, inputs and veterinary care and also digital content services such as training and market information.

iii. Facilitating improved access to produce markets and returns through organizing smallholders, and linking them to agribusinesses.

To realize these objectives, a number of activities have been lined up in the course of the program timescale. Key among these are support services that will go towards building the capacity of Farmers Producers Organizations (FPOs) in order for them to better deliver value to their members and integrate more appropriately with the markets both up and down stream. Initially the program will focus on FPOs in dairy, maize, potatoes, rice and livestock.

ILRI

"Better lives through livestock"

The International Livestock Research Institute (ILRI) works to improve food security and reduce poverty in developing countries through research for better and more sustainable use of livestock. ILRI is a **CGIAR research centre** – part of a global research partnership for a food-secure future.

DIAMOND V

A leading global animal health company

More than 75 years of science, innovation, technology, and quality have earned Diamond V the reputation of The Trusted Experts in Nutrition and Health™.

Our purpose: To help animals do better so producers are more successful and food is safer, and to help people live more healthy days and improve their quality of life.

Our vision: Diamond V will be the world leader in delivering natural, science-based, sustainable technologies that improve animal health, protect the environment, solve pre-harvest food safety issues, and advance public health.

Our expertise:

- **Fermentation:** Proprietary anaerobic fermentation technology that creates unique natural immune support products with multiple benefits.
- **Technical:** Trusted team of experts transferring science-based knowledge and building relationships that result in trusted, enduring partnerships.
- **Research:** Every product thoroughly tested and validated with controlled research, including over 120 peer-reviewed publications validating our base technologies

VITABIOTICS

Vitabiotics was founded in 1971 by Dr Kartar Lalvani and in 1990 Prof Beckett was appointed as the chairman. Between 2000 and 2008 Vitabiotics won awards including Vision 100 and Award 2001 as one of the UK's top 100 most visionary companies by BT. From 2008 to date Vitabiotics has won JP Morgan, Family Business and Boots Supplier of the Year Awards.

Vitabiotics Numbers in Building a global organization and is present in over 110 countries worldwide. All product categories are manufactured to the same high pharmaceutical standards of quality assurance (FDA, MHRA, GMP and THM). Being a number one category leading brands in the UK supplement market, we are passionate about Health, Formula & innovation, Market segmentation, Marketing expertise, Branding and packaging and Proven effectiveness.

Vitavet is Vitabiotics division for the formulation of pet's products namely Super dog Health & Vitality and Super dog Bones & Joints. We are involved in Corporate & Social Responsibility ensuring that we build a reputation of trust and integrity e.g. Battersea Dogs and Cats home.

NORBROOK

Norbrook Kenya Limited is a subsidiary of Norbrook Pharmaceuticals Worldwide with the company headquarters in Newry, Northern Ireland (UK).

Norbrook Kenya Limited is proud to be associated with Kenya veterinary association as a Gold sponsor. Norbrook is committed to providing farmers with high quality animal Health products. With world class facilities, which are licensed by major governmental regulatory authorities worldwide, Norbrook manufactures a comprehensive. Range of own-brand products and contract manufactured products.

Norbrook remains a world leader in Pharmaceutical Manufacture, Research and Development, with production facilities on 4 continents with Norbrook Kenya limited on the African continent. The sales and distribution offices are located in over 150 countries with over 200 pharmaceutical products registered worldwide. Our staff count is upwards of 2,000 employees worldwide.

Norbrook is ready to meet the challenges of providing cost effective, high quality pharmaceuticals for our customers, backed by professional and dedicated sales and marketing support teams. The sun never sets on Norbrook in its relentless pursuit for excellence.

Contacts: Old Limuru Road, Kiruri P.O. Box 1287-00606, Sarit Center Nairobi Tel +254 020 201456/7 Fax + 254 020 2019456 E-mail:sales@norbook.co.ke

METROVET

At our veterinary surgery in the heart of Wood Green, we aim to offer a full and highly professional service whilst keeping costs affordable and ensuring value for every penny you spend with us.
We want to be part of your local community and make sure that all pets can have the veterinary care and treatment they need.
Our fantastic staff are friendly and approachable and are always available as a source of knowledge and information. And our duty of care means your pet comes first, no matter what.

VET CARE

Vet care Kenya Limited was established following the need for quality veterinary medicine and services. It is recognized for its commitment to the productions of high quality veterinary products both locally and internationally. With the changing times, the company has invested in technology and makes consistent research and development of its products for the promotion of better animal health.
Vet care Kenya Limited has grown over the years with stability fueling confidence from the available market. The company conforms to the standard laid down by International standard for both

manufacturing and services. Solid management practices together with enthusiastic commitment, forms the foundation for its continued advancement on the domestic and international markets.
Vet care Kenya Limited manufactures a wide range of products for treating ailments in all domestic animals in the following formulations:

- Injectables
- Water Soluble Powders
- Oral Liquids
- Feed Additives

KEVEVAPI
Most of livestock diseases are endemic and pose severe constrains to the livestock industry. They cause economic losses through deaths and decreased production. Some countries like the United States of America and Great Britain have used slaughter and compensation policy in control of Foot and Mouth and New Castle diseases. However, it is a very expensive policy for a developing country like Kenya to undertake. The only affordable alternative is vaccination; hence the more the need for a functional local veterinary vaccines production facility, thus KEVEVAPI, to provide the appropriate vaccines for the country. The Institute has been in existence as a Centre under Kenya Agricultural Research Institute (KARI) and has been producing vaccines to meet the local demand. This has enhanced the livestock industry to contribute to the GDP.

MEDISEL (K) LIMITED
Medisel Kenya Limited has over the last 20 years become one of the top 5 pharma companies in Kenya with a turnover of nearly $20m. The company continues to grow by leaps and bounds now exporting to over half a dozen countries in East and Central Africa.
With over 200 employees and a strong and experienced sales and marketing force, keeps the company ahead of its competition on many levels. Medisel (K) Limited has a reputed name in the medical fraternity across East and Central Africa supplying and marketing quality pharmaceutical/surgical products and allied hospital disposables and equipment.

TATA CHEMICALS MAGADI LIMITED
Tata Chemicals Magadi, part of the global Tata group, is one of the world's leading chemical companies, with a widespread portfolio of industrial chemicals and agricultural inputs. Tata Chemicals Magadi Limited (TCML) occupies a significant place in the African economy. We are one of Kenya's leading exporters and the largest mineral deposit in Africa. Our mineral deposit, Lake Magadi, is also home to the most pure salt in the world. Our heritage spans more than 100 years of producing the best natural salt, produced at source. Our salt contains elements of sodium, chloride and sodium bicarbonate.

Our product portfolio includes Soda Ash**,** Crushed Refined Soda (CRS)**,** Magadi Industrial salt**,** Magadi Livestock salt**,** Magadi Moore Nyama and Magadi Moore Maziwa.

Sustainability is core to our operations. We are an equal opportunity employer and have built deep connections with the local community through a number of health, education and employment initiatives over the decades.

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PATHOLOGISTS
LANCET
KENYA (PLK)
Key to diagnostic excellence
Maabara ya Kisasa


COSMOS

Cosmos Cares...for Better Health


KENYA DAIRY BOARD
"Quality milk for health"


KUKU MFALME
KENCHIC


KENYA ANIMAL GENETIC RESOURCES CENTRE
KAGRC
For Superior Animal Genetics


WASHINGTON STATE
UNIVERSITY


ILRI
INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE


Diamond V


KCB
FOUNDATION


Norbrook


VITABIOTICS
SCIENCE OF HEALTHY LIVING


VETCARE
AFRICA


medisel
(KENYA) LIMITED


KENYA VETERINARY VACCINES PRODUCTION INSTITUTE
KEVEVAPI


THE KENYA VETERINARY ASSOCIATION
KVA


HARAMBEE


KVB
KENYA VETERINARY BOARD


ELGON KENYA
1898


TATA
TATA CHEMICALS MAGADI
SERVING SOCIETY THROUGH SCIENCE

THE DONKEY SANCTUARY	Metrovet	BROOKE ACTION FOR WORKING HORSES AND DONKEYS
FAO FIAT PANIS	HighChem Essentials	KEMIN
CKL COOPER K-BRANDS LTD	IFAW	ceva
WORLD ANIMAL PROTECTION	Bimeda	KCB BANK MobiGrow
BAYER	HIGHER EDUCATION LOANS BOARD HELB FINANCING HIGHER EDUCATION	

THE KENYA VETERINARY ASSOCIATION

KVA

...improving the livelihoods of Kenyans

SAVE THE DATES
53rd
KVA ANNUAL SCIENTIFIC CONFERENCE
APRIL 24TH - 27TH 2019

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