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CONTINUING EDUCATION PRESENTER

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CONTINUING EDUCATION PRESENTATIONS

Rushton, J.¹

IMPORTANCE OF ASSESSING THE ECONOMIC IMPACT OF DISEASE

A framework for the overall economic assessment of the impact of an animal disease or health problem will be presented examining: (1) production losses; (2) the costs of surveillance prevention and control; and (3) the wider societal impacts of market changes and suboptimal use of technologies. The presentation will explore how such impact assessments can be used to prioritise diseases and health problems, and also how they can be used to look at control programme efficiencies for each disease. These assessments are useful to provide baselines against which new interventions and changes in policy can be assessed.

MAKING EFFECTIVE ECONOMIC ASSESSMENTS OF ANIMAL HEALTH INTERVENTIONS

New vaccines, antimicrobials and managerial strategies for responding to disease presence or risk require economic assessments to provide information about whether a change is likely to be, or has been, beneficial. The presentation will discuss the common economic methods used in animal health to assess the impact of changes, beginning with partial budget analysis, cost benefit analysis and decision tree analysis. It will question why cost-effectiveness analysis, a tool commonly used in human health, is not used more frequently. The presentation will discuss key parameters used in economic analysis such as the discount rate. It will also cover how the results from ex-ante and ex-post economic analysis need to be used in reviewing past actions and for the implementation of future projects.

HOW ECONOMICS SHAPES RESPONSES TO DISEASE PRESENCE AND RISK

Our responses to disease presence or risk are normally framed as a rational process, with prices of animals, livestock products and control technologies guiding our actions. Such a market-oriented paradigm can restrict our thinking. The presentation will explore how human medicine and health has become increasingly important in society, as the effective market value placed on human life has increased. At the same time there has been a rise in the market value of pet animals, and an associated reduction in the value placed on livestock. These shifts in relative value have skewed investments in health, and it is questioned whether these investments now truly reflect the importance of different species from a perspective of health and sustainability. The presentation will ask people to carefully consider how prices are set in any economic analysis. Where prices do not truly reflect costs to society and the environment there needs to be modification of the analysis. This is discussed in terms of antimicrobial use, with antimicrobials being a common good, and African horse sickness, a disease that affects poor and rich alike.

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THE ECONOMIC IMPACT OF BLUETONGUE AND OTHER ORBIVIRUSES IN SUB-SAHARAN AFRICA WITH SPECIAL REFERENCE TO SOUTHERN AFRICA

Grewar, J.D.¹

In Southern African countries, the generally endemic orbiviral disease status, of which bluetongue (BT) and African horse sickness (AHS) can be considered most important, makes these diseases challenging to quantify in terms of their economic impact. Using country reported data of BT and AHS outbreaks and cases, as well as international trade data, the economic impact of BT and AHS in southern Africa is evaluated on local, regional and global scales.

Local scale impact in the southern African region is underestimated as evidenced by the underreporting of BT and AHS, with the exception being during epidemic cycles of disease and, as in the case of AHS in South Africa, when disease impacts on regional animal movement and global trade. While BT is not directly implicated as a significant non-tariff barrier for regional movement, there are unspecified clauses in import permits referring to 'OIE listed diseases' and the freedom thereof which includes endemic diseases like BT. AHS has a much more tangible regional and global economic impact through movement restrictions within AHS control zones in South Africa and through international movement of horses from this country.

Economic impacts of disease are often only looked at from a negative point of view. However, with BT and AHS being present in southern Africa for many decades, the research focus of academic institutions in southern Africa have included understanding various aspects of these diseases. Globally this research has given AHS and BT free regions and countries the opportunity to make scientifically orientated decisions regarding orbiviral diseases and their control. This has hopefully led to an improved economic situation for these countries given that risk based trade can occur and be improved with our expanding knowledge of orbiviruses.

(This work was initially presented at the Fourth International Conference on Bluetongue and Related Orbiviruses, Rome, 5-7 November 2014 and has been accepted for publication in Veterinaria Italiana)

FACTORS INFLUENCING THE COMPETITIVENESS OF SMALLHOLDER PIG FARMERS IN THE NORTHERN CAPE PROVINCE OF SOUTH AFRICA

Matekwe, N.¹

Pork is one of the most important sources of relatively cheap protein in South Africa. Looking at the factors influencing the competitiveness of smallholder pig farmers in South Africa is therefore important in order for one to maximise the positive factors and minimise the negative or put countermeasures in place for the negative factors influencing competitiveness. In general, there is high demand for pig meat in South Africa as evidenced by the high dependency on imported pork products over the years. Therefore improving the competitiveness of the smallholder pig producers will go a long way towards improving the socioeconomic conditions and food security in South Africa's rural communities.

The research's main objective was to identify smallholder pig producers' perception of the important and critical factors that drive and influence their competitiveness in South Africa. This is important to elucidate and understand why the smallholder pig producer sector has remained relatively less competitive than the commercial pork production sector of the pig industry. A carefully designed and structured questionnaire aligned to the Porter methodology framework was developed and completed by smallholder pig producers in order to identify the perception of the critical factors that drive and influence their competitiveness. A correlation coefficient analysis was carried out in order to interpret the underlying perceptions of the producers. The different business environments (macro-, micro- and meso-environments) were used to group the factors as was done by Will (2004) and Roduner (2005). The significant macro, micro and meso-environment factors that have an impact on the competitiveness of smallholder pig producers in the Northern Cape Province were identified.

EMERGENCY PREPAREDNESS IN THE AGRICULTURAL AND RURAL DEVELOPMENT SECTORS

Lwanga-Iga, I.¹ & Lwanga-Iga, S.

South Africa is going through the worst drought ever in 50 years, which has had very severe immediate consequences in the agricultural and rural development sectors, resulting in compromised crop and animal production. The long term consequences are yet to come and these will be felt during the next one to two years characterised by low crop and animal production, shortages of staple food and fodder, increased imports of staple food, reduction in exports and fodder, threats to job security in the sector, culminating in a real threat to livelihoods and the economy, especially in the rural areas. Though five of the seven Provinces have declared this drought as provincial disasters as regulated by the Act, the National Government did not find it fit to do the same for the country as a whole for whatever reasons. The possibility of a drought in South Africa as a result of El Nino was predicted well over two years ago, therefore the current drought could not have been a surprise to anybody operating in these sectors. The response to the current drought especially by the state apparatus has been “very lukewarm to mild” to say the least and at best not adequately coordinated. The questions which arise here are: Could earlier interventions have minimised the effects of this drought? Would the response have been different had we been prepared? Are the three spheres of Government capacitated to deal with such an occurrence with the urgency it deserves? Is there coordination among the current role players who are dealing with the current drought? This paper attempts to shed light on the way various stakeholders have responded to this drought and also introduces an innovation which could contribute to possible improvement in our preparedness and response should we experience another drought in future from a provincial perspective.

AN EVALUATION OF THE WHAT3WORDS® COORDINATE SYSTEM FOR USE IN SOUTH AFRICAN VETERINARY SERVICES

Pienaar, N.J.¹

what3words® (w3w) is an addressing technology that gives a geographic location by using a three dictionary word combination. Its advantages are that the coordinate is easy to remember, easy to write down and difficult to confuse with other formats. Coordinate reporting for animal disease reporting in South African Veterinary Services is sometimes incorrect due to confusion between the different formats and latitude and longitude. Disadvantages of the what3words® format are that it is not yet available on all GPS devices and access to the internet is needed to convert between what3words® and other formats.

THE PREVALENCE OF CFT SEROPOSITIVE DOURINE HORSES IN THE RURAL COMMUNITIES OF KWAZULU-NATAL

Halgreen, S.¹ & Chisi, S.

There is little known about the current status of the controlled animal disease dourine within the population of horses contributing to the rural communities' livelihood, in KwaZulu-Natal. Last year there were a total of four reported positive cases within South Africa, three in KwaZulu-Natal and one in the Eastern Cape. The plan of the study was to determine the prevalence of the disease in stallions within the rural communities of the Uthukela, Umgungundlovi and Sisonke districts and to determine the need for future intervention and primary animal health care.

Preliminary results; a total of 125 horses have been tested with a total of 28 seropositive horses. The overall prevalence of Dourine in the following districts is as follows in the Uthukela District, Bergville 7% and Injisuthi 33%; in the Umgungundlovu District, Sweetwaters 10%; in the Sisonke District, Kokstad 8% and Umzimkhulu 46%.

This is a clear indication that there is a need for further surveillance, typing of *Trypanosoma equiperdum*, as well as education about the disease in the rural communities.

A STUDY OF LEPTOSPIROSIS IN SOUTH AFRICAN HORSES AND ASSOCIATED RISK FACTORS

Simbizi, V.^{1,5}, Saulez, M.N.², Potts, A.³, Lötter, C.³ & Gummow, B.^{4,5}

Leptospirosis in horses often occurs without noticeable clinical signs; however, acute disease manifestations as well as reproductive failure and recurrent uveitis have been reported. In South Africa, the epidemiology of the disease in horses is not well documented. This study determined the serovars of *Leptospira* present in horses in Gauteng, KwaZulu-Natal and Western Cape and associated risk factors. A serosurvey, comprising 663 horse sera collected by four large equine hospitals, was carried out using the microscopic agglutination test. Owners were interviewed to obtain information on associated risk factors.

The most predominant serovars in Gauteng were Bratislava [32%, 95% CI: 29-35%]; Djasiman [10.4%, 95% CI: 8-12%] and Arborea [8.9%, 95% CI: 7-11%], in the Western Cape Province, Bratislava [27.35%, 95% CI: 23-32]; Djasiman [15.4%, 95% CI: 12-19%] and Arborea [14.5%, 95% CI: 11-18%] and in KwaZulu-Natal, Bratislava [39.4%, 95% CI: 34-44%]; Arborea [9.6%, 95% CI: 7-13%]; and Tarassovi [7.7%, 95% CI: 5-10%] respectively. The apparent prevalence to one or more serovars of *Leptospira* at a serum dilution of 1:100 in Gauteng, KwaZulu-Natal and Western Cape Provinces were 49% (95% CI: 24-74%); 37% (95% CI: 20-54%) and 32% (95% CI: 26-39%) respectively. Twenty one serovars representing 17 serogroups were detected in South African horses with serovar Bratislava being the most serodominant. Nooitgedacht (South African horse breed) horses were found to be at greater risk of being seropositive to both serovar Bratislava (OR=5.08) and *Leptospira* spp (OR=6.3). Similarly, horses residing on properties with forestry in the vicinity were found to be at greater risk of being seropositive to both serovar Bratislava (OR=9.3) and *Leptospira* spp (OR=5.2). This study has shown that a high proportion of horses in South Africa are exposed to a wide range of serovars, inferring a complex epidemiology. It also describes for the first time new serovars of *Leptospira* in horses in South Africa that have not previously been reported.

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BOVINE BRUCELLOSIS SEROPREVALENCE SURVEY IN GAUTENG, NOV 2015 – MAR 2016

Govindasamy K.¹, Geertsma P.J. & Abernethy D.A.

INTRODUCTION

Bovine brucellosis is a bacterial zoonotic disease of cattle that is of international public health and economic importance. It is a controlled animal disease and a notifiable condition in humans in South Africa. In Gauteng the point prevalence in cattle herds is unknown despite routine passive surveillance in the province.

AIM & OBJECTIVES

In this study we determine the herd and within-herd seroprevalence of bovine brucellosis in Gauteng stratified by State Vet Area and herd size to establish the baseline prevalence from which the effectiveness of the provincial control strategy will be assessed going forward.

MATERIAL & METHODS

A cross sectional design was used for a prevalence survey of cattle herds in Gauteng. The GIS layer “GT-Farm-Portions” excluding built up areas, was used and 707 portions were randomly selected. A sample size of 353 was calculated using a within herd prevalence of 1.93% and a 95% confidence interval (Epi-Z Software). A herd was defined as a herd having at least one cow older than 18 months. Maps were issued to the technicians indicating the selected point. The herd at that point or closest to that point was sampled. The number of cattle randomly selected from a herd for testing was predetermined. Technicians were trained on how to randomly select animals from the herds as well as on the administration of a questionnaire. Sampling occurred from November 2015 to March 2016. Samples were sent to the Ondesterpoort Veterinary Laboratory for analysis and results were reported to us through the routine surveillance system. Data from the questionnaire and results of the tests were captured in an ACCESS 2010 database and analysed using ACCESS 2010.

RESULTS & DISCUSSION

The cattle prevalence for Gauteng is 1.27% (30/2359). The herd prevalence for Gauteng is 13.7% (24/175). The herd prevalence for Pretoria is 13.0%, Germiston is 10% and Randfontein is 27.8%. The cattle prevalence (within herd prevalence) for Gauteng was 1.3% (30/2359), Pretoria was 1.15%, Randfontein 1.9% and Germiston 0.74%. There were 51 sample points of greater than 20 cows older than 18 months. 26.8% of these larger herds were brucellosis positive. Of these, 26 are in Pretoria- prevalence 23.1%, 16 herds were sampled in Germiston- prevalence 25% and the remaining 8 herds in Randfontein- 50% (4/8) positive. The rest of the samples consisted of herds less than 20 cows older than 18 months, having an overall herd prevalence of 6.6%, with Pretoria having a 6.1%, Germiston 6.3%, and Randfontein an 11.1% (1/9) herd prevalence.

These results indicate that brucellosis is more prevalent in larger herds and has an unequal distribution in the province. The distribution of vaccination status stratified by herd size and State Vet Area will be presented. The impact of these results on the control strategy for bovine brucellosis in Gauteng going forward will be discussed.

EXPLORING THE RISK OF SALMONELLA GALLINARUM TO EMERGING FARMERS DUE TO THE ECONOMICS, TRADE AND MOVEMENT BETWEEN CHICKEN CULL DEPOTS IN GAUTENG, SOUTH AFRICA

Govindasamy K., Petty D. & Geertsma P.J.¹

INTRODUCTION

Salmonella gallinarum is controlled bacterial disease that is spread horizontally between chickens in South Africa. *S. gallinarum* produces clinical salmonellosis in chickens and results in economic loss to the farmer due to severe mortality in chicks, retardation in growth of survivors, reduced egg production, low fertility and hatchability of eggs laid by carriers and increased mortality among semi mature and adult stock due to an acute outbreak. Gauteng province has a number of chicken cull depots for spent layer hen sales that supply emerging farmers and the local community. However, movement and trade between the depots and farmers have not been determined in the past.

AIM & OBJECTIVES

In this study we undertook to map the movement and risk factors between selected chicken cull depots and emerging farmers and the public to determine the risk of spread and maintenance of *S. gallinarum*.

MATERIAL & METHODS

This was a cross sectional study of selected cull depots using structured questionnaire administered face to face to determine the movement, trade and risk factors for *S. gallinarum*. Data from the questionnaire was captured into an ACCESS 2010 database and analysed using R and a social networking tool.

RESULTS & DISCUSSION

We will be reporting the risk factors for *S. gallinarum* within the cull depots as per State Vet Area. We will be displaying the distribution of high risk nodes in Gauteng and their proximity to commercial chicken farms of trade importance.

CLOSING THE DOOR AFTER THE ‘CHICKEN’ HAS BOLTED - SALMONELLA GALLINARUM CONTROL IN THE WESTERN CAPE

Pypers, A. R.¹, Grewar, J.D. & van Helden, L.S.

Historically the Western Cape has been free of *Salmonella gallinarum* (SG) otherwise known as Fowl typhoid. In 2015 two separate outbreaks occurred in the Western Cape in two different state veterinary areas. These outbreaks were managed successfully and to date have not resulted in any further problems.

In January 2016, a third outbreak was diagnosed on a farm at the foot of the Paardeberg mountain. This multi-age commercial layer farm, that is part of a larger commercial operation, is situated in the Western Cape's only Densely Populated Poultry Area (DPPA).

Although SG is not a zoonosis and therefore raises no public health concerns, it can lead to significant mortalities and is characteristically hard to eradicate.

This paper describes the control measures instigated by State Veterinary Services in order to control the outbreak, the events that transpired and the many lessons learnt. It also examines the severe constraints that were encountered as a result of a troubling trend within the South African poultry industry and suggests some potential solutions that need to be tackled through a public private partnership.

CONTROL OF OVINE JOHNE'S DISEASE IN THE NORTHERN CAPE PROVINCE: A CASE REPORT

Matekwe, N.¹

A farm in the Northern Cape Province was suspected of having been infected with ovine Johne's disease (OJD) when the owner of the farm bought 406 sheep at an auction. The sheep came from a known OJD infected farm in a neighbouring province. The farm was immediately put under quarantine and disease control measures were put in place. Serological tests (ELISA) were performed on serum samples from all the 406 bought in sheep and 18 (4.43%) tested positive. All the sheep (406) were slaughtered at a registered abattoir and 20 tissue samples (ileocaecal valves and mesenteric lymph nodes) were collected for histopathology using the immunoperoxidase staining technique and 10 (50%) of them tested positive. Following the successful slaughter of all the 406 bought in sheep, OJD sero-surveillance was done on the farm as well as 17 contact farms. Random samples were taken from sheep that were at least 24 months old. 7 samples (1.3%) from 5 farms tested positive for OJD using ELISA, however, tissue samples from the positive animals were negative for OJD on histopathology. The sample size was increased and the five positive farms were retested and only one sample (0.4%) tested positive for OJD on ELISA but was negative on histopathology. In addition to the serological and histopathological tests done, as a way of assessing a risk factor associated with the survival and propagation of OJD in the environment, soil samples for pH determination were taken from the infected farm. The results showed that the pH of the soil does not favour the prolonged survival of OJD's causative agent in the environment. Subsequent serological and histopathological retests were carried out on the farm at intervals determined by the provincial veterinary services and the farm was finally removed from quarantine when the provincial veterinary authority was satisfied that the farm had attained freedom from OJD.

SEQUENCE DIVERSITY OF THE LEUKOTOXIN OPERON IN *MANNHEIMIA HAEMOLYTICA* ISOLATES FROM SHEEP IN SOUTH AFRICA

Gelaw, A.K.¹ & Bihon, W.²

The molecular evolution and sequence diversity of the leukotoxin operon (lkt CABD) of *Mannheimia haemolytica* was investigated by comparison of the gene sequence from 12 ovine isolates. We used MEGA version 6.0 genomic workbench for the alignment and analysis of the nucleotide data sets. It was shown that the codon-based non-synonymous substitution was greater than the synonymous substitution ($p < 0.05$) that implies the positive selection for the overall sequence pairs. Results from Fisher's Exact test of Neutrality of Sequence pairs also demonstrated the significant variation between the number of synonymous and non-synonymous substitutions between each sequence pairs ($p < 0.05$). The evolutionary history of the taxa was inferred using the minimum evolution method and phylogenetic tree was constructed in Neighbour-joining method.

This preliminary data showing substantial sequence variations of the leukotoxin operon of *M. haemolytica* isolates from ovine origin support the hypothesis that ovine isolates of *M. haemolytica* are most diverse. This could also be one of the reasons that a single leukotoxin based vaccine was shown not to confer solid protection against manheimiosis in sheep.

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COST-BENEFIT ANALYSIS OF CONTROL PROGRAMMES FOR ANIMAL AFRICAN TRYPANOSOMIASIS: CASE STUDY IN ZAMBIA

Meyer, A.¹, Holt, H., Chilongo, K. & Guitian, J.

Animal African Trypanosomosis (AAT) is a major constraint on livestock production in Sub-Saharan Africa. It has been estimated that the disease reduces cattle numbers as well as milk and meat outputs by up to 50% in areas where it is present. Extensive control activities for AAT and its main vector, the tsetse, have been implemented in Africa for over a century. However, there are limited data on the economic return of these programmes available to inform the design of future control operations.

This study aimed to estimate the likely returns of different AAT and tsetse (T&T) control strategies, based on the outputs of a stochastic model developed to estimate the impact of AAT on cattle production, which were used as inputs of a cost-benefit analysis of potential T&T control activities. The model was parametrized with data from the Mambwe district of the Eastern Region of Zambia, which is considered by the Zambia Veterinary Services as a potential target for future T&T control efforts. Three scenarios were simulated to compare the economic performance of three alternative control programmes with a baseline situation where T&T control is implemented by cattle owners only (scenario 0). The four publically funded control programmes considered were based respectively on aerial spraying of insecticides (scenarios 1 and 2) and impregnated targets (scenarios 3 and 4). The programme Tsetse Muse (<http://www.tsetse.org/muse>) was used to predict the likely reduction in tsetse density under each scenario and thus the likely reduction in annual incidence of AAT used to model the disease impact. The maintenance of barriers to prevent tsetse reinvasion was accounted for, as the district considered is adjacent to other tsetse-infested areas. Annual costs and benefits of the selected control activities were calculated for a 10-year period, using a discount rate of 5%. The annual impact of AAT in the district was calculated as the sum of the disease costs (production losses) and the farm-level intervention costs (trypanocidal and insecticidal treatments). Benefits of the control activities implemented under scenarios 1 to 4 were calculated as the difference between the losses incurred in the baseline scenario and the losses incurred in alternative scenarios.

Annual losses incurred to AAT were estimated at 1.4 million USD for the whole district, under the existing disease prevalence, accounting for reduced meat, milk and draft power outputs as well as mortality. Preliminary results suggest that tsetse elimination in Mambwe district would be achieved within two years under scenarios 3 and 4 and one year under scenarios 1 and 2. The benefit-cost ratio calculated for scenarios 1, 2, 3 and 4 were respectively 3.4, 2.8, 3.1 and 2.5. The total discounted control costs and benefits for the 10-year period were estimated at respectively 2.2 and 7.5 million USD for scenario 1. The model is now being refined further and extensive sensitivity analysis is being conducted, however, the results obtained strongly support a high cost-effectiveness of coordinated T&T control. After further validation, this tool could be integrated in the range of frameworks and recommendations available to decision-makers comparing different T&T control strategies and ranking geographical areas where implementing control measures would be most beneficial.

A CANDID ASSESSMENT OF TRADE IN LIVESTOCK PRODUCTS FOR COUNTRIES IN THE SADC REGION FROM A REGIONAL AND INTERNATIONAL PERSPECTIVE

Mulumba, M.¹

In less than 10 years, the global meat (beef, pork, poultry) and other livestock products (eggs, milk) exports have grown over 40%. The forecast for 2016 is expected to continue on the upward trend based on rising incomes and stronger demand. These export opportunities have largely bypassed Africa save for only three countries on the continent: Botswana, Namibia and Swaziland (all based in the SADC region). On the other hand, South Africa and the entire SADC region (including the 3 exporters) remain net importers of meat products and continue to serve as a source of enrichment to other exporters to the detriment of the local livestock industry. The predicted emergence and growth of the middle class due to rising incomes is likely to increase the import bill. Statistics show that intra-SADC trade in agriculture including livestock, accounts for only $\frac{1}{3}$ of the total trade of SADC countries. While requirements for disease freedom, especially FMD, are often cited as the main constraint to intra-SADC trade, there is sufficient evidence to suggest that intra-SADC trade in livestock products can still take place at higher levels than is currently the case using alternative safe OIE approved guidelines. Countries like India that are not free from FMD still trade successfully in livestock products.

It is argued that if the local livestock industry is to prosper and manage to meet the protein requirements of the rising population of the region, trade in livestock and livestock products domestically and regionally must be encouraged and promoted, livestock value chains must be improved, commodity based trade approach must be used as a trade tool and reliable and current trade data must be easily accessible

RISK ANALYSIS IN ANIMAL HEALTH: THREAT OR OPPORTUNITY FOR AFRICA?

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Risk analysis originated in the aerospace industry following the loss of life due to a fire on Apollo flight AS-204 in 1967. The tool was later developed in the nuclear industry for the reactor safety. It reached the animal health sector through the Sanitary and Phytosanitary (SPS) agreement signed in 1994 during the Marrakech agreement of the General Agreement on Tariffs and Trade (GATT). The SPS agreement entered into force with the establishment of the World Trade Organization (WTO) on 1 January 1995.

The SPS agreement recognises the World Organisation for Animal Health (OIE) as the relevant international organization entrusted with the development of import risk analysis techniques in animal health. The (appropriate) level of protection that countries imposed to avoid ingress of highly infectious diseases through restriction of imports had to be based on scientific principles (i.e. risk analysis).

Development of risk analysis studies requires available data, teamwork, as well as specific skills. One can understand the impact of such studies in terms of access to market for specific commodities and in terms of protection against transboundary diseases introduction.

We assessed the extent to which risk analysis is used in Africa in compliance with OIE standards and guidelines, through a study based on two approaches. A questionnaire evaluating the capacity, capacity building and the risk assessment studies produced or received was carried out through all the African countries. In parallel, the risk analysis section of evaluation reports produced by OIE in almost all African countries as part of the Performance of Veterinary Services (PVS) pathway was analysed.

Results allowed us to draw a picture of the situation in Africa regarding the use of this very technical tool as well as to formulate some recommendations to improve the sanitary protection and the access of African countries to international markets.

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QUANTITATIVE RISK ASSESSMENT FOR AFRICAN HORSE SICKNESS IN LIVE HORSES EXPORTED FROM SOUTH AFRICA

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African horse sickness (AHS) is a severe, often fatal, arbovirus infection of horses, transmitted by *Culicoides* spp. midges. AHS occurs in most of sub-Saharan Africa and is a significant impediment to export of live horses from infected countries, such as South Africa. A stochastic risk model was developed to estimate the probability of exporting an undetected AHS-infected horse through a vector protected pre-export quarantine facility, in accordance with OIE recommendations for trade from an infected country. The model also allows for additional risk management measures, including multiple PCR tests prior to and during pre-export quarantine and optionally during post-arrival quarantine, as well as for comparison of risk associated with exports from a demonstrated low-risk area for AHS and an area where AHS is endemic. If 1 million horses were exported from the low-risk area with no post-arrival quarantine we estimate the median number of infected horses to be 5.4 (95% prediction interval 0.5 to 41). This equates to an annual probability of 0.0016 (95% PI: 0.00015 to 0.012) assuming 300 horses exported per year. An additional PCR test while in vector-protected post-arrival quarantine reduced these probabilities by approximately 12-fold. Probabilities for horses exported from an area where AHS is endemic were approximately 15 to 17 times higher than for horses exported from the low-risk area under comparable scenarios. The probability of undetected AHS infection in horses exported from an infected country can be minimised by appropriate risk management measures. The final choice of risk management measures depends on the level of risk acceptable to the importing country.

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QUANTITATIVE ASSESSMENT OF THE RISK OF RELEASE OF FOOT-AND-MOUTH DISEASE VIRUS VIA EXPORT OF BULL SEMEN: A CASE STUDY

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The export of semen collected from vaccinated bulls in foot-and-mouth disease (FMD) infected areas is regulated by the Terrestrial Animal Health Code of the OIE, as vaccination may lead to the asymptomatic excretion of FMD virus via the bulls' semen. Since the virus is relatively resistant in semen, artificial insemination with contaminated bull semen may lead to the infection of the receiver cow. Therefore systematic testing of all the semen doses intended for export is recommended although it is an expensive practice.

The purpose of this study was to model the risk of release of FMD virus through export of bull semen from a non-FMD-free country, in order to estimate the risk incurred for FMD-free countries considering purchasing such bull semen as well as the risk reduction provided by systematic testing of the semen doses. A stochastic risk assessment model was built to estimate the risk of release, defined as the annual likelihood of exporting at least one dose of bull semen contaminated with viable FMD virus. The model was parametrised with data from Israel, which is a non-FMD-free country currently engaged in international trade of bull semen. Several scenarios were investigated to account for uncertainty around specific model parameters and to evaluate the effect of performing a pre-export test on semen doses.

Under the most plausible risk scenario, the annual likelihood of exporting bull semen contaminated with FMD virus had a median of $2.7 * 10^{-8}$. This corresponds to one infected dose exported every 37 million years. Under the worst case scenario, the median of the risk rose to $2.8 * 10^{-5}$ which is equivalent to the export of one infected dose every 35,759 years. For constant levels of the model parameters, the risk of release is lowered by a factor of 2 when a pre-export test is performed on half of the semen doses and by a factor of between 20 and 30 (depending on the levels of the other parameters) when a pre-export test is performed on all semen doses.

Our model assumed that the bull semen was sourced from a dedicated bull stud enforcing relatively high biosecurity measures and annual vaccination of the animals. The very low risk estimates reported above suggest that the trade of bull semen produced in such facilities in non-FMD-free countries is unlikely to lead to the infection of susceptible animals in an FMD-free country. The implementation of pre-export tests on only half of the semen doses could be a cost-effective risk mitigation strategy.

EVALUATION OF THE SOUTH AFRICAN BOVINE SPONGIFORM ENCEPHALOPATHY SURVEILLANCE SYSTEM, 2012-2015

Govender, V.¹, Magwedere, K., Qekwana, C.P., Reddy, D. & Gibbs, C

Bovine Spongiform Encephalopathy (BSE) is a fatal progressive neurological disease of adult cattle and is linked to Creutzfeldt-Jakob disease in humans. Although no case of BSE has ever been documented in South Africa, the World Organisation for Animal Health (OIE) considers the status of BSE in South Africa to be the lowest category of “undetermined risk” and as such, imports of beef may not be restricted on the basis of BSE risk status.

The surveillance system was evaluated against the OIE guidelines for BSE-status recognition. The usefulness was assessed by considering actions taken based on information from the system and the anticipated future uses of the data. We sourced data from questionnaires administered to provincial state veterinarians and monthly laboratory reports of all samples tested from January 2012 to May 2015 at the National BSE laboratory.

The quantification of acceptability of the system was based on the participation of eight out of nine provinces and was determined to be 88.9%. Missing data of critical variables were used to assess data quality. Out of the 20,378 samples, data for 8,837 samples (43.4%) for the critical variable, age of the animal, were missing. Out of the 20,378 samples analysed, 29 (0.14%) originated from active surveillance at farm level. All samples were suitable for laboratory testing and therefore compliance to the sampling protocol was deemed to be 100%. The stability of the system was determined to be 87.8%.

The system was found to be useful. The effectiveness needs to be improved. Sampling targets for active and passive surveillance need to be reviewed. Existing collaborations within veterinary services must be strengthened to improve the system’s ability to meet its objective of continuous monitoring of BSE in the country. The recommendations of the evaluation will contribute to the revision of the BSE surveillance protocol under the Animal Diseases Act (Act No. 35 of 1984).

A REVIEW OF ETHNOVETERINARY MEDICINE AND THE TREATMENT OF REPRODUCTIVE DISORDERS

Ndou, R.V.¹, Materechera, S., Otang W.M., & Mwanza, M.

Both the success and sustainability of livestock farming enterprises are affected by the reproduction of animals. Failure of animals to reproduce can be attributed to multiple etiologies that include, amongst others, infectious diseases, metabolic diseases, postpartum diseases and anatomical and physiological disorders. Prior to the introduction of orthodox veterinary medicine, farmers depended on indigenous knowledge and practices to treat reproductive disorders and other health problems in animals. Such knowledge and practices were perfected over time by trial and error and were passed on from one generation to the next mostly through oral transfer. Due to western influences in Africa, the practices were discarded in some regions and even labeled “magico-religious”, superstitious or unsubstantiated. However, ethnoveterinary medicine (EVM) is still dominant in many rural farming communities where limited modern veterinary health care services exist, and also amongst poor farmers who cannot afford veterinary fees. In recent years, great interest has developed globally in indigenous knowledge systems due to many reasons including the embracing of cultural heritage by many African countries after liberation from colonial rule and also the quest for alternative medicine after realizing limitations of some modern drugs. The interest has led to descriptive studies for the purpose of recording and preserving the indigenous EVM knowledge through interaction with communities.

In South Africa there are several published data available on medicinal plants used for animal health care in different regions. Studies include work conducted in Limpopo, North West and KwaZulu Natal and Eastern Cape Provinces which documented EVM knowledge and practices in some districts. The data includes the names of the medicinal plants and their preparation protocols for treatment of reproductive disorders and this review was generated from those manuscripts. This review details 37 species of medicinal plants representing 32 families used for treatment of reproductive disorders such as retained placenta, endometritis, dystocia, abortions and fertility problems in livestock. It also discusses studies conducted to validate the efficacy of plant usage using bioassay for *in-vitro* antibacterial and anti-inflammatory activities of the plant extracts. Furthermore phytochemical screening results of selected plants will also be deliberated.

The review has noted a decrease in number of recent published work on EVM and observed that there are many areas of the country whose indigenous knowledge still remains undocumented. The rich cultural and biological diversity that exists in South Africa calls for further exploration of the country’s EVM knowledge as potential resource for development. It is recommended that in addition to medicinal plant surveys, studies to determine the acclaimed efficacy of identified plants should be undertaken in order to validate the medicinal properties of those plants.

WELFARE OF GRAZING DAIRY COWS UNDER SMALLHOLDER PRODUCTION SYSTEMS IN MIDLANDS PROVINCE, ZIMBABWE

Matore Z.¹, Woods P. & Kageler S.

Zimbabwe's smallholder dairy is characterized by high mortalities, high production cost and substandard husbandry practices. These challenges affect dairy cow welfare and consequently productivity and profitability of the dairy business. A cross sectional study was conducted on 41 smallholder dairy farms and 86 cows were examined from August to September 2015 in Midlands Province, Zimbabwe to determine the risk factors and indicators to impaired cow welfare and also farmer perceptions of cow welfare. Farmer questionnaire and direct farm observations were conducted to determine risk factors and cows were then observed to determine indicators of impaired welfare. 5% of the observed cows were severely lame and 30% were moderately lame, lameness was associated with absence of shade ($p<0.001$) and low dipping frequency ($p=0.007$); 42 % of the cows were manure stained and this was associated with manure accumulation ($p<0.001$) in more than 80% of the observed cattle pens; 58% of the cows had low body condition scores ($BC<3$), low BC was associated with low frequency of protein ($p=0.002$) and vitamin ($p=0.012$) supplementation recorded in more than 52% of the farms visited; 64% of the cows were not touched and this was associated with shouting ($p=0.012$) and whipping of cows ($p=0.002$), 46% of the cows had skin lesions, more than 32% of the pens had sharp protruding poles and 26% of the farmers used metal feeding troughs with rough sharp edges. 88% of the farmers regarded physical needs of cow welfare as highly important compared to wellbeing needs and there were large discrepancies between observed and mild lameness. It was concluded that poor welfare of dairy cows existed in more than 90% of the smallholder dairy farms studied as evinced by management and husbandry practices that were below expected standards. It was also concluded that cow welfare is poor and is poorly perceived by more than 90% of the smallholder farmers.

A REVIEW OF THE NEUTRALISING ANTIBODY TITRATION IN SERA OF DOGS AND CATS VACCINATED AGAINST RABIES AND DESTINED FOR INTERNATIONAL MOVEMENT

Miyen, J., Mathuloe, H., Mohale, D., Ngoepe, E., Phahladira, B., Malepe, K. & Sabeta, C.¹

International regulations governing movement of domestic carnivores, particularly dogs and cats from rabies-infected to rabies-free countries, have recently been relaxed, with the adoption of a system that combines vaccination against rabies and serological monitoring. With this system, a neutralising antibody titration test with a threshold of 0.5 IU/ml demonstrates an adequate response to vaccination. Since 2005, the OIE Rabies Reference Laboratory at Onderstepoort was approved as a facility to test serum samples for purposes of pet movement. The facility has analysed at least 25,000 sera from dogs and cats using a viral sero-neutralisation technique. Statistical analyses performed on the data demonstrated that in general cats respond much better than dogs to vaccination with the currently used inactivated vaccines. Finally, the results of the analyses showed a strong correlation between antibody titre and the time that elapsed between the last vaccination and the blood sampling. The presentation will therefore provide an overview of data of the sero-neutralisation tests undertaken at the OIE Rabies Reference Laboratory since 2005.

DYNAMICS OF FMDV TRANSMISSION IN THE ACUTE AND PERSISTENT PHASE OF INFECTION IN BUFFALO

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Foot-and-mouth disease virus (FMDV) circulates as multiple serotypes and strains in many endemic regions. In particular the three Southern African Territories (SAT) serotypes are maintained effectively in their wildlife reservoir, the African buffalo, and individuals may harbour multiple SAT-serotypes for extended periods in the pharyngeal region. However the mechanism for persistence remains unclear. Three groups of naïve African buffaloes (n=4) housed separately were infected with a SAT1, or SAT2 or SAT3 virus, which were originally isolated from field buffaloes. Naïve buffalo (n=4) were introduced into each group of infected buffalo to allow transmission up to 35 days post infection (dpi). Probang, tonsillar swab and serum samples collected from animals were tested for the presence of FMDV specific antibodies using ELISA tests and the presence of virus or viral RNA was confirmed using the antigen ELISA, virus isolation and real-time PCR assays. All naïve animals were confirmed positive, these animals were then terminated at 35 dpi.

To investigate FMDV transmission in the chronic or persistence phase (>35 dpi) using diet as a possible trigger, animals were separated into two groups each comprising originally infected SAT1 (n=2), SAT2 (n=2), SAT3 (n=2) animals, with the introduction of new naïve buffalo (n=6). One group was placed on a protein-calorie restricted diet and the other group acted as the control. By 90 dpi, transmission had occurred with all naïve animals irrespective of diet as a trigger with SAT1 being transmitted most frequently, followed by SAT3. Co-transmission of multiple SATs also occurred (n=5) in animals. Further transmission events occurred from 160 dpi until termination 240 dpi. In the past most attempts at demonstrating transmission between carrier and susceptible buffalo under experimental conditions have been unsuccessful, this study provides proof of FMDV transmission between buffalo.

OUTBREAKS OF AFRICAN HORSE SICKNESS IN THE WESTERN CAPE PROVINCE, SOUTH AFRICA (2004-2014) ASSOCIATED WITH LIVE, ATTENUATED VACCINE VIRUSES

Weyer, C.T.¹ & Guthrie, A.J.

African horse sickness, a frequently fatal disease of horses, donkeys and other equines is presently restricted to sub-Saharan Africa but has the potential to spread to the rest of the world. The disease is caused by a virus called African horse sickness virus and is essentially untreatable. It can, however, be effectively controlled by vaccination of uninfected animals with weakened versions of the virus that do not cause severe disease. Without such vaccines there would be a collapse in horse populations throughout sub-Saharan Africa. Here we examine outbreaks of African horse sickness at the southern tip of the continent in an area which has been historically free of disease, with only sporadic outbreaks occurring, and find that many of these outbreaks were likely caused by the weakened viruses that have been used as vaccines. Genetic analyses of 39 apparently vaccine-derived viruses that had naturally spread revealed that all of them had undergone genetic changes which are likely to have increased their potential to cause disease. It is likely therefore that the vaccine that is enabling the survival of horses in southern Africa is paradoxically endangering susceptible horses within the regions where African horse sickness has been largely eradicated.

THE EPIDEMIOLOGY OF ZONOTIC ARBOVIRUSES AS A CAUSE OF NEUROLOGICAL DISEASE IN HORSES AND WILDLIFE IN SOUTH AFRICA, 2008-2015

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BACKGROUND

The incidence of West Nile virus (WNV) and other endemic arboviruses in humans and animals cases of neurological disease in Africa is unknown. Since 2008 we have traced zoonotic arbovirus activity, defined seasonality, host-range, molecular epidemiology and vectors involved as an early warning for outbreaks in humans in South Africa.

METHODS

Countrywide passive surveillance was conducted for acute febrile and neurological disease in horses (since 2008) livestock and wildlife (since 2010). Active vector surveillance was conducted at four sentinel sites in Gauteng, Limpopo and Mpumalanga provinces (2011-2015) where cases were previously detected. Specimens were screened for flaviviruses, alphaviruses, Shuni virus (SHUV) and equine encephalosis (EEV) as differential by PCR and WNV IgM ELISA.

RESULTS

Of the 1299 cases received, 798 (61%) presented with neurological signs and 507 (39%) were fatal. Overall 275 specimens tested positive; 254 (92%) horses, 17 (6%) wildlife and 4 (1%) livestock. The most frequently detected zoonotic arboviruses were WNV (93; 34%) followed by Middelburgvirus (68; 25%); SHUV (23; 8%) and Sindbis (19; 7%) and reflects the ratio of positive horse cases. Wildlife cases included (1/17, 6%) WNV, (9/17, 53%) Middelburg, (4/17, 24% SHUV and (5/17, 29%) Sindbis. Livestock included 2 WNV and 2 Middelburgvirus positive cattle. Of the 93 WNV cases, 64(69%) displayed neurological signs and 33(35%) died. All but two WNV cases, from a horse and aborted fetus, clustered with lineage 2. Signs significantly associated with WNV were anorexia (adjusted relative risk ratio (aRRR)=0.38;95% CI 0.05-0.15), paralysis (aRRR=2.17; 95% CI 1.03-4.6), recumbence (aRRR=0.4; 95% CI 0.17-0.96) and tongue paralysis (aRRR=10.65; 95% CI 1.7-65.5). Of the 68 Middelburg cases 53 (78%) exhibited neurological signs and 27 (40%) were fatal. Signs significantly associated with Middelburg were non-specified neurological signs (aRRR=2.4; 95% CI 1.2-5.3). Cases occurred from February to June, peaking in March throughout the country, corresponding to high vector populations.

CONCLUSION

WNV and Middelburg virus were the most frequently detected arboviruses in animals with neurological signs in South Africa, causing disease in horses, livestock and wildlife across the country. These viruses should also be considered in human cases of febrile or neurological disease in late summer when vectors are most abundant.

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SPATIAL DISTRIBUTION OF BOVINE TRYPANOSOMIASIS IN MALAWI

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The epidemiology of livestock transmitted trypanosomiasis is affected by changes in the environment. The interaction of livestock, wildlife, humans and the vector also affects the epidemiology of the disease. In this study we report on the spatial distribution of bovine trypanosomiasis in Malawi.

A cross sectional study was conducted to establish the prevalence of bovine trypanosomiasis. Multistage sampling was performed at dip tanks in 13 selected districts distributed among the three regions of the country. A total of 444 blood samples were collected from cattle between January 2016 and February 2016. Samples were screened for trypanosomiasis using an indirect ELISA and PCR. Sample to positive ratios were calculated as, $S/P = (\text{Sample optical density (OD)} - \text{Negative control OD}) / (\text{Positive control OD} - \text{Negative control OD})$. Distribution of the frequencies of the results of serological data were tested for normality by plotting histograms and performing a Shapiro-Wilk normality test. S/P ratios were transformed using the natural logarithm and averaged over all sampled cows in each area. Serological results were then linked with their geographical locations. Risk maps were created by interpolation of the S/P ratio using ordinary Kriging. The Moran's I was used to estimate the spatial autocorrelation of bovine trypanosomiasis based on the natural logarithm of the S/P ratio.

The identification of high risk areas for trypanosomiasis will help in implementing effective prevention, control and mitigation measures of bovine trypanosomiasis in Malawi.

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IDENTIFYING HIGH RISK AREAS FOR FMDV OUTBREAKS IN SOUTH AFRICA

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Foot-and-mouth disease (FMD) is a controlled (notifiable) disease in accordance with the South African Animal Diseases Act (Act 35) of 1984. In 1996, the International Committee on FMD of the OIE endorsed South Africa's FMD free status without vaccination. According to the OIE status, the areas excluded from the free zone were the endemically infected Kruger National Park and the FMD protection areas. The occurrence of at least one FMD outbreak per year in the protection zone during the last 15 years (except for 2 years) is a continued threat of the FMD-free status. The majority of the outbreaks were caused by the South African Territories (SAT) type 1 and 2 viruses in cattle. These outbreaks elevate concerns about the efficiency and sustainability of FMD control measures within the protection areas.

Isopleth risk maps were developed to identify high risk areas in Mpumalanga and Limpopo Provinces. Data were collected from provincial veterinary services and World Animal Health Information Database (WAHIS) Interface for the period 2005-2015. SAT1 and SAT2 FMD viruses were selected for modelling. The proportion of affected cattle at the dip-tank level was calculated and used as the dependent variable. Data were assessed for normality by plotting histograms, calculating descriptive statistics, and performing the Anderson-Darling test for normality. Data for each serotype and a combined analysis were interpolated using ordinary kriging of reported outbreaks. Moran's I was used to estimate the spatial autocorrelation of FMD outbreaks in cattle within the protection zone of South Africa.

Data presented can assist with strengthening current FMD control measures and contribute to the development of further quantitative models.

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EFFECTIVE USE OF RISK MAPS AND SPATIAL MODELS TO INFORM RISK-BASED DECISION-MAKING: A COMPARISON OF MODELLING METHODS

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INTRODUCTION

Predictive disease distribution models and maps are valuable tools for informing risk-based disease control and surveillance decision-making. Although statistical models, in particular generalized regression methods, have long been the most widely used approach during the last decade, the purview of predictive disease modelling methods has expanded to include a range of machine learning algorithms, yet the epidemiological literature provides little direction regarding key differences between methods.

AIM

The aim of this study was to compare three modelling methods with respect to predictive accuracy, predicted disease distribution and identification of variables associated with disease distribution, using highly pathogenic avian influenza virus (HPAIV) H5N1 as an exemplar disease.

METHODS

Three modelling methods were considered: Bayesian mixed effects logistic regression (MELR), boosted regression trees (BRT) and Maxent. Model inputs were HPAI H5N1 outbreak data extracted from the EMPRES Global Animal Disease Information System (January 2004-October 2010) together with randomly generated pseudoabsence data.

RESULTS

Predictive accuracy of the Bayesian MELR and BRT models was excellent (AUC 0.95 and 0.93 respectively) while that of Maxent was good (AUC 0.803) yet the three distribution maps were noticeably different. All maps broadly identified key HPAI H5N1 hotspots yet there was considerable uncertainty regarding predicted distribution extent. However, combining the maps to create an ensemble map showed that these were better able to identify areas with low rather than high probability of virus presence. Both the BRT and Maxent models identified density of domestic waterfowl to be the predictor of most importance followed by proximity to rice-growing areas. The focus of the Bayesian MELR was human population density and proximity to roads. However, distribution of model residuals suggested this emphasis on human population density was likely due to sampling bias in the data.

CONCLUSION

Model outputs differed between the three methods and were affected to different extents by biases in the data. Yet, this limitation can be exploited; by identifying where the models agree or disagree allows the level of uncertainty surrounding model predictions to be mapped. The ability of the models to identify areas of low risk with greater certainty than areas of high risk, suggests that predictive maps are more effectively used in a process of elimination rather than identification. By eliminating areas with a low probability of pathogen presence, control and surveillance strategies can then focus on those areas with a potentially high probability of pathogen presence.

MICROBIOLOGICAL AND COMPOSITIONAL QUALITY OF RAW MILK DELIVERED BY SMALL SCALE DAIRY FARMERS TO THE MILK COLLECTION CENTRES

Mboya, N.¹, Banda, P.¹ & Kurwijila, L.²

Milk samples were collected from small scale dairy farmers who brought their milk to MCC's and vendors in the study area. A total of 310 milk samples were collected. The bacteriological quality, physicochemical parameters and milk adulteration with sulfur and tetracycline residues were assessed. Microbiological quality evaluation was done basing on TBC, TCC, *E.coli* and *E.coli* pathogenic (O157: H7). For the sake of comparisons milk samples from Turiani and Mlandizi were added for antimicrobial residues analysis. Questionnaires were used to collect data on the survey. Microbiological analyses were carried out using standard cultures, physicochemical properties by use of Automatic Milk Analyser machine and antibiotic residues by using Charm EZ technique. Questionnaires revealed that 91% were drying the udder after washing, 75% were cleaning milk containers with hot water and 86.7% of farmers were using plastic containers to keep milk. Physicochemical properties of milk were within the standardized range. Drug residues were positive for farmers' milk samples but not vendors. The mean bacterial counts were within acceptable limit as per EAC standards. *E.coli* was detected to a level of 54% but no *E.coli* pathogenic were detected. More quality tests such as iodine and alcohol tests are recommended to make sure that the milk is free from adulteration with other materials apart from water.

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SALMONELLOSIS AS A NEGLECTED AND EMERGING ZOOONOTIC THREAT IN AFRICA: SITUATION IN SOUTH AFRICA

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Typhoidal and non-typhoidal salmonellosis have emerged as a prominent cause of bloodstream infection in both children and adults in Africa with fatality up to 25% in some countries and as high as 47% in hospital cases. While the menace continues to increase, the route of transmission of typhoidal *Salmonella* and hosts reservoir of non-typhoidal *Salmonella* are not yet fully understood in the African context. Despite some perceived general views, there are diverse challenges peculiar to each country that create a thriving environment for salmonellosis. These necessitate the study or appraisal of historical and contemporary epidemiology of salmonellosis in Africa. South Africa is the fifth most populous country in Africa and currently has the most advanced economy with 30% of the population classified in the middle income earning. Over 45% of the current estimated population of about 55 million people live in urban settings. In terms of personnel, laboratory facilities and international collaborations, South Africa has the capacity to curb the threat of salmonellosis and to support other African countries. However, a review of 97 accessible publications on salmonellosis in South Africa reveals very limited and fragmented scientific evidence of the epidemiology of the infection and disease. A few reports exist on attempts to monitor the level of *Salmonella* infections and to systematically reduce the level of *Salmonella* in meat products and water consumed by humans. However, to date, there is a dearth of information on research generated data (routes of transmission, reservoir hosts, circulating serovars and genomic characteristics) to document baseline data on the prevalence of *Salmonella* spp. to use as a reference for a *Salmonella* reduction initiative in the country. Meanwhile, the majority of reports available are on clinical patients presented at human and veterinary clinics or hospitals, which do not directly measure the risk of salmonellosis to humans and animals in the country. Reports in South Africa have documented prevalence rates for *Salmonella* spp. ranging from 43.8% to 64.7% in poultry meat with the predominant serovars being *S. Hadar*, *S. Blockley*, *S. Irumu*, *S. Anatum*, *S. Readings*, *S. Virchow*, *S. Schwarzengrund*, *S. Westhampton*, *S. Typhimurium*, *S. Derby* and *S. Heidelberg*. With the existing gaps on *Salmonella* infection and salmonellosis in humans and animals in South Africa the need for concerted efforts to determine the epidemiology of salmonellosis, including conventional and molecular characterization of *Salmonella* spp., cannot be over-emphasized. Prevention and control of *Salmonella* infection in poultry and other livestock are vital measures to counter the threat of human salmonellosis in South Africa. This is very important because of the role of South Africa as an exporter of poultry, ostriches and livestock products to other part of the world including Africa, especially other members of South African Development Community.

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SEROPREVALENCE AND KNOWLEDGE OF BOVINE BRUCELLOSIS IN FARM WORKERS, ANIMAL HEALTH TECHNICIANS AND ABATTOIR WORKERS IN GAUTENG, 2016 – A PILOT STUDY

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INTRODUCTION

Bovine brucellosis is a bacterial zoonotic disease of cattle that is of international public health and economic importance. In South Africa the prevalence amongst high risk groups of people, is unknown despite brucellosis being a national notifiable disease.

AIM & OBJECTIVES

In this study we determine the seroprevalence of bovine brucellosis in farm workers on *Brucella* farms identified as positive between 2014 and 2016, in animal health technicians who service those farms, and workers at selected abattoirs, some of which are registered to slaughter *Brucella* positive cattle in Gauteng. Secondly we determine the knowledge of brucellosis in these groups. Finally, being a pilot study, we document the logistics and lessons learnt in approaching the aforementioned high risk groups from a One Health perspective.

MATERIAL & METHODS

A cross sectional design is being used for a prevalence survey of selected high risk groups in Gauteng province using a structured questionnaire administered face to face. A multidisciplinary team consisting of a medical doctor, a veterinarian and an animal health technician is being used for the field visit and interviews. The team was trained on the administration of the questionnaire. The medical doctor collects 5 ml of blood in serum separated tubes from each person and the blood is packaged on ice and delivered to the National Institute for Communicable Diseases that day. The samples are processed using the *Brucella* Capt serological kit and Elisa. PCR is conducted on positive samples. Data from the questionnaire and results of the tests are captured in an ACCESS 2010 database and analysed using ACCESS 2010 and R.

RESULTS & DISCUSSION

Seroprevalence, stratified by area and occupation will be presented as will differences in knowledge of brucellosis between the groups. Finally, the structure and logistics needed for a functioning “One Health” epidemiological team will be highlighted as well as the operational lessons learnt during the study. The implications of the results for brucellosis control in South Africa will be explored.

BRUCELLA MELITENSIS BIOVAR 3 INFECTION IN SABLE ANTELOPE (*HIPPOTRAGUS NIGER*) IN SOUTH AFRICA

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HISTORY

A four-year-old sable antelope (*Hippotragus niger*) cow and three other sable heifers from the Madibeng District in the North West Province were purchased in July 2013 at an auction, and introduced into a group of sable antelopes in an intensive breeding system. In mid-2014 the cow developed swelling of multiple joints. A private veterinarian examined her in November 2014. At the time she was also found to be pregnant. She was treated for bacterial arthritis, but did not respond to therapy.

The OVAH (Onderstepoort Veterinary Academic Hospital, University of Pretoria) was approached in June 2015 for a second opinion. The cow did not have a calf-at-foot and it was assumed that she aborted between December 2014 and April 2015. Based on the known association of *Brucella* and the presence of the multiple joint swellings, assumed to be hygromas, it was decided to exclude a *Brucella* infection as a cause of the condition.

RESULTS

Clinical examination

On routine clinical examination, the animal was not lame and had large swellings over the carpal and tarsal joints.

Cytology

Fine needle aspirates (FNA) consisted of clear, straw-coloured fluid containing a few fibrin strands. Diff-Quick smears of the FNA revealed mainly macrophages of which some were multinucleated giant cells, lymphocytes, plasma cells, and degenerate neutrophils characteristic of a chronic inflammatory exudate. Stamp's-stained smears contained few, positive-staining, small, phagocytized bacterial cocci.

Serology

Blood for serology was collected from the sable cow and from a heifer that shared a boma with her at the auction in 2013. Rose Bengal, complement fixation, and serum agglutination tests were performed and both animals were positive for *Brucella* spp. infection in all three tests.

Bacterial culture

Brucella melitensis biovar 3 was cultured from the fluid aspirated from the swellings over the joints using *Brucella* specific culture media.

Necropsy and histopathology

Both animals were in their first trimester of pregnancy. The swellings over the joints contained a serofibrinous exudate characterised by a clear, straw-coloured fluid containing large quantities of fibrin. These subcutaneous, fluid-filled cavities did not communicate with either the tendon sheaths or with the joint cavity of the underlying joints, possibly explaining the lack of clinical lameness. Histopathology of the wall of the cystic cavity revealed a granulomatous inflammatory reaction consisting mainly of macrophages (including epithelioid and multinucleated giant cells), plasma cells, and some lymphocytes in the subcutaneous and hypodermal layers. Examination of other tissues and organs revealed only a micro-granulomatous hepatitis.

Following further investigation, another seven sables from the group were serologically positive for *Brucella* spp.. They were also culled and necropsies were performed. Similar carpal and tarsal swellings in the early stages of development were present in all the animals. Tissues submitted for bacterial culture and histopathology yielded similar results to those in the other two animals. *Brucella melitensis* biovar 3 was cultured from the uterus and mammary gland in the females, the vesicular gland in one of the males, and from the lymph nodes, spleen, and the carpal lesions from all the animals. No bacteria were cultured from the foetal organs.

CONCLUSION

This is the first documented report of *Brucella melitensis* biovar 3 infection in sable antelope in South Africa. The source of the infection remains unknown and the prevalence of *B. melitensis* biovar 3 in wildlife and in small stock in South Africa is probably underestimated. This event emphasizes the need to diagnose *Brucella* infections to species level to determine the epidemiology and relevance of the disease in mammals, including humans in which this infection is an important zoonosis.

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HOST IMMUNE RESPONSE PROFILES OF CALVES FOLLOWING VACCINATION WITH LIVE BCG AND INACTIVATED *MYCOBACTERIUM BOVIS* VACCINE CANDIDATES

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Bovine tuberculosis (BTB) caused by *Mycobacterium bovis* (*M. bovis*) occurs endemically in livestock and wildlife in parts of southern Africa and is detrimental to socio-economics and conservation efforts. Test-and-slaughter schemes to control BTB have proved inefficient in many developing countries with a human-wildlife-livestock interface and limited surveillance of animal diseases. Vaccination is therefore considered an alternative control strategy. The safety of the use of live BCG in cattle in an area of high HIV prevalence, however, is not known. As such vaccination with inactivated vaccine candidates may provide a safer alternative.

The aim of this study was to investigate cellular and humoral immune responses of cattle vaccinated with live *M. bovis* BCG Danish compared to two inactivated *M. bovis* vaccine candidates. Twenty-four calves, aged 4-6 months, were randomly divided into 4 groups and vaccinated sub-cutaneously with either live *M. bovis* BCG; formalin-inactivated BCG; heat-killed *M. bovis* or PBS/Montanide™ (control). Animals receiving inactivated vaccines were boosted at 3 weeks post-priming. Interferon-gamma responsiveness and antibody production were measured prior to vaccination and at weekly intervals up to 9 weeks after vaccination using the BOVIGAM assay to measure interferon-gamma and the IDEXX TB serum ELISA, respectively. At week 9 the animals were subjected to a skin test with bovine and avian tuberculins (PPD-B and PPD-A).

The animals in the heat-killed *M. bovis* group showed significantly higher responses in both assays compared to those in the control group as well as the groups that received live or inactivated BCG. Cell-mediated immunity in the heat-killed *M. bovis* group peaked at week 4 post-priming and showed significantly elevated OD readouts (OD-bovine PPD minus OD-avian PPD) up to 3,3 fold until week 9 ($p < 0.05$). Significant humoral responsiveness in the heat-killed *M. bovis* group was observed at week 3 post-priming, and antibody levels steadily increased up to 99.4 fold compared to the control group at week 9. Treatment groups vaccinated with live and inactivated BCG did not show significantly raised levels of cell-mediated or humoral immune responses compared to the control group in the course of 9 weeks. In the tuberculin skin test, the live BCG and the heat-killed *M. bovis* vaccinated animals showed significant responses (PPD-B minus PPD-A).

In conclusion, the heat-killed *M. bovis* vaccine was shown to elicit strong and sustained cell-mediated, both interferon-gamma and skin test readings, as well as humoral immune responses in calves and warrants further investigation in experimental and/or field challenge studies.

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