Food and Agriculture Organization of the United Nations

AFRICA SUSTAINABLE LIVESTOCK 2050

Zoonotic diseases spotlight

UGANDA

The case for an expert elicitation protocol on zoonoses

The Republic of Uganda

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ASL 2050

Zoonotic diseases spotlight
The case for an expert elicitation protocol in Uganda

1. Introduction

Decision-makers at all levels must appreciate the current and future impact of livestock sector on public health, the environment and livelihoods in rapidly changing societies, such as that of Uganda. This is necessary for them to take actions now that ensure a sustainable development of livestock in the coming decades, a development that benefits producers, consumers and the society more in general, and has limited, if any negative effects on public health and the environment.

Good quality data and information are essential for formulating policies and programmes that support a sustainable development of livestock. However, livestock stakeholders and the Ministries in charge of animal and public health in particular, often face what is here referred to as "the zoonotic disease and antimicrobial resistance (AMR) information trap". As there is no robust evidence to quantify the negative impact of zoonotic diseases and AMR on society, stakeholders find it hard to robustly demonstrate the returns of programmes and investments that tackle zoonoses and AMR; to secure resources to that end; and to create that necessary partnership between the government and the governed to address issues interweaving public and private dimensions.

This brief provides a snapshot of the information system on zoonotic diseases and AMR in Uganda. It then makes the case for implementing an expert elicitation protocol to assemble data on the impact of zoonoses and AMR on society. Results from implementing such a protocol can contribute to break the "zoonotic disease and AMR information trap", thereby allowing Uganda to enter into a virtuous circle of information gathering, knowledge generation and policy reforms, which is essential to address current and emerging zoonotic and AMR issues successfully.

2. Zoonoses and anti-microbial resistance in Uganda: the evidence for decision-making

Zoonotic diseases and livestock-driven AMR negatively impact on society, for example through reducing the quantity and value of the produce from livestock; worsening the trade balance; decreasing labour productivity; making households and the government use resources to treat sick animals and humans rather than for productive purposes. When zoonoses turn into pandemics, their impact on society escalates and can be devastating, as the experiences of Highly Pathogenic Avian Influenza in Asia and the Ebola Virus Epidemic in West Africa show. AMR is an emerging global threat and its toll on human society is on the increase. For example, the World Health Organization (WHO) reports that, among the new cases of tuberculosis in 2014, an estimate 3.3 percent were multidrug-resistant (WHO, 2016).

The capacity of livestock stakeholders, beginning with the national government, to manage and contain zoonotic diseases and livestock-driven AMR depends, beyond human and financial resources availability, on access to good quality data and information. These allow assessing the current and potential effects of zoonotic diseases and AMR on society, and measure the returns on investments for their containment and management. Good quality data and information should be available on:

i. The incidence and prevalence of zoonotic diseases by livestock production system (e.g. intensive vs. semi-intensive vs. extensive);

ii. The use of antibiotics in livestock, disaggregated by animal species and production system;
iii. The incidence and prevalence of zoonotic diseases in humans, by category of people (e.g. farmers vs. market operators vs. consumers);
iv. The use of antibiotics and antimicrobial resistance in humans, by category of people;
v. The reduction in the quantity and value of livestock production due to zoonoses, because for example of death and morbidity in animals; the reduction in labour productivity, with zoonoses potentially affecting labourers in any sector of the economy; the value of private and public resources used to deal with zoonoses, which cannot be thus allocated for more productive purposes:
vi. The causes of the emergence and spread of zoonotic diseases in animals and their transmission to humans, such as inadequate vaccination coverage, inefficient biosecurity and biosafety measures; the causes of the inappropriate use of antibiotics in animals, such as for non-therapeutic purpose, and of the emergence of AMR in human beings. These causes should be the target or focus of policy actions. Indeed, investing resources to measure zoonoses and AMR, without information on their root causes, is of little help for decision-makers.
vii. The feasibility – such as in terms of financial resources and technical competencies– of possible interventions to tackle the root causes of the emergence and spread of zoonoses and of livestock-driven AMR. This information helps identify actionable interventions and estimate their different returns, i.e. to allocate available resources to maximise the benefits for society.
viii. Volume and value of trade of livestock commodities and animals and possible impacts of ultimate bans on exports.

In Uganda, stakeholders agreed upon priority zoonotic diseases both in humans and animals. In humans, they include the viral haemorrhagic fevers (Ebola, Marburg, CCHF, and RVF), plague, anthrax, rabies, tuberculosis, brucellosis, zoonotic influenza viruses and trypanosomiasis (CDC, 2017). The prioritized diseases identified in animals are brucellosis, hydatidosis, salmonellosis, cysticercosis, tuberculosis, highly pathogenic avian influenza, anthrax, rabies and trypanosomiasis (Global Health Security Agenda GHSA, 2017; see Appendix 3). The threat of AMR has also been placed at the forefront due to the high intensity of use of antibiotics for disease management, particularly in market-oriented exotic and cross-bred livestock. Such antibiotics include penicillin, erythromycin, ampicillin and tetracycline (Byarugaba, Kisame and Olet, 2011).

The government of Uganda regularly allocates resources to prevent, manage and control zoonotic diseases public-health risks. For instance, every year it holds an anti-rabies week to remind the general public and technicians the health threat created by rabies and the importance of actions to manage it: it has endorsed laws for controlling zoonotic diseases like rabies and trypanosomiasis and that regulate the use of antibiotics; the Zoonotic Diseases Coordination Office (ZDCO), hosted in the Ministry of Health, is mandated to organise responses to public health threats originating in zoonoses; the Ministry of Agriculture, Animal Industry and Fisheries and the Ministry of Health coordinate a one health platform that engage stakeholders, from national to district level, to prevent, respond and manage zoonotic diseases in a coordinated an interagency high level National Task Force (NTF) has established to monitor the status of public health threats in the country.

The capacity of the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) and the Ministry of Health (MoH) to successfully operationalize current zoonotic-disease control policies and strategies depend on the availability of good quality data and information. As far as data collection is concerned, MoH assembles a Weekly Reporting Form for priority

diseases (Form 033B, see Appendix I.A, B and C). The tool is designed for the use of Health Workers, based at local health facilities, and assists them in assembling the information they collect at local level on number of cases and deaths of malaria, dysentery, Severe Acute Respiratory Infection (SARI), Acute Flaccid Paralysis and Adverse Events Following Immunization (AEFI) (Appendix I.A). Local Health Workers also report, upon occurrence, on other diseases (small pox, influenza like illness -ILI, SARS, Ebola) and on landslides, drought, floods and other conditions that could affect human health (Appendix I.C). M-Trac (Mobile phones or computer software) is the channel used for forwarding this data to the Ministry of Health, which aggregates local data to generate national statistics (Appendix I.B).

As to zoonotic diseases in animals, sub-county Livestock/Veterinary officers are responsible for the collection of livestock-related data during their daily activities. They insert the data they collect in a monthly surveillance data reporting form. On a monthly basis, the District Livestock/Veterinary Officer compiles and assembles the data gathered by extension officers in the various sub-counties and submits a pre-designed livestock data reporting form to MAAIF, through his/her respective Chief Administrative Officer (see Appendix 2). It is notable that District Authorities are not legally obliged to report to MAAIF, as they are subordinated to the Ministry of Local Government. The livestock data report that districts compile on a monthly basis includes information on a variety of dimensions, including on 'Outbreaks of contagious diseases', on 28 major diseases, including numbers of animals affected and at risk, and action taken to control/manage any outbreak. In particular, they report on the following zoonoses: anthrax, bovine tuberculosis, salmonellosis, brucellosis, hydatidosis, trypanosomiasis, rabies, rift valley fever and BSE among others. Other disease reporting mechanisms are the passive surveillance template, the AU-IBAR monthly animal health report, the rmergency reporting letter to CAH within 24 hours of any outbreak of notifiable diseases, such as highly pathogenic avian influenza, Foot and Mouth Disease, etc.

District Authorities do not always report to MAAIF as expected. In 2012, for example, only 27 percent of the Districts regularly submitted their reports to MAAIF and in most cases the reports were incomplete. The most reported item in the reports is the "general information" section, namely basic information on rainfall pattern; water availability and grazing conditions, which is present in 56 percent of the submitted report (Pica-Ciamarra *et al.*, 2014). Improvements in data collection using mobile based applications such as the event mobile application/Empres-I, Open data kit (ODK), Animal resource information system (ARIS 1 & 2) have been piloted in some districts but not fully scaled up.

Given the current information system and its functioning, the Ugandan ministries in charge of livestock and public health are not in a position to generate accurate data estimates of the incidence and prevalence of zoonoses and livestock-driven AMR; demonstrate the returns of programmes and investments for their management and control; and create that necessary partnership between the government and the citizens to address issues that interweave public and private dimensions. The government, therefore, faces what is here defined as the "*antimicrobial and AMR information trap*".

3. An expert elicitation protocol for assembling information on zoonoses and AMR

In situations where there is insufficient or unreliable data, or when data is either too costly or physically impossible to gather, expert elicitations are a promising tool to obtain good quality information. They are a scientific consensus methodology to get experts' judgements on the distribution of the variables and parameters of interest, including those whose value is either unknown or uncertain. An important feature of expert elicitation is that experts not only provide information on the unmeasured, but can also suggest values that differ from those in the scientific literature or from official statistics (the official knowns), because for example

they believe some causal linkages are underestimated or some issues underreported. The public sector, but more frequently private parties, have used expert elicitations for a multitude of purposes, such as to investigate the nature and extent of climate change; the cost and performance of alternative energy technologies; the health impact of air pollution (Morgan, 2014). The World Health Organization used an expert elicitation to estimate the global burden of foodborne diseases (WHO, 2015).

The FAO Africa Sustainable Livestock 2050 Initiative (ASL2050), under the guidance of a National Steering Committee comprising representatives of the Ministry of Agriculture Animal Industry and Fisheries, the Ministry of Water and Environment and the Ministry of Health, has developed an expert elicitation protocol to assemble quantitative information on zoonoses and livestock driven AMR in Uganda. As the Ugandan livestock sector is heterogeneous, it was agreed to start designing and testing the protocol for two production systems, four zoonoses and AMR. The two production systems include beef and chicken meat, while the four zoonoses are bovine tuberculosis and brucellosis for cattle; and salmonellosis and highly pathogenic avian influenza (HPAI) for poultry (see box 1 and box 2). These were selected because of their relevance not only for Uganda but also for other ASL2050 countries, including Burkina Faso, Egypt, Ethiopia, Kenya and Nigeria, which in the medium-term will facilitate cross-learning.

Box 1. Cattle production systems, bovine tuberculosis and brucellosis

Beef cattle is one of the main agricultural industries in Uganda, contributing about to 6.8 % to agricultural value added (UBOS, 2017). The majority of cattle farmers are smallholders, with the greatest concentration of livestock found in the "*cattle corridor*", extending from South-Western to North Eastern Uganda. There are four major production cattle production systems including semi-intensive, agro-pastoral, pastoral and ranching systems. Producers rear cattle primarily for milk and, to a minor extent, for meat.

Brucellosis is an infectious, chronic disease of livestock and humans caused by *Brucella* bacteria. The major clinical signs in cattle are repetitive abortions. The symptoms in humans are profuse undulant fever with muscle and bone pain, etc. The disease can be detected through serological tests or bacterial culture. Brucellosis transmission from cattle to humans is usually from ingesting unpasteurised dairy products or raw meat, and through direct contact with infected blood or other secretions. Animal to animal transmission is from direct contact with infected bodily secretions. The economic consequences of brucellosis include reduction in livestock production due to decreased milk productivity because of loss of young ones/abortions, as well as public and private health costs.

Bovine tuberculosis (bTB) is a chronic infectious disease of animals and humans caused by *Mycobacterium bovis (M. bovis*) of the *M. tuberculosis* complex. It is widely distributed throughout the developing world. In humans, tuberculosis caused by M. *tuberculosis* as well as by *M. bovis* has become increasingly important due to its association with HIV/AIDS. Symptoms in humans include fever, weight loss, night sweats, and in the most common form of pulmonary tuberculosis, coughing and blood-stained sputum. In animals the clinical signs are coughing, dyspnoea, gastrointestinal problems, bone deformation, and emaciation. Diagnostic methods include direct staining of tissue, sputum or other secretions, bacterial culturing, or DNA amplification by PCR. The intradermal tuberculin test is the main diagnostic tool used in control programmes of bovine TB. The principal route of human infection with *M. bovis* is by ingestion of contaminated products such as infected milk. The economic impacts of bTB in humans result from treatment costs while

in livestock economic impacts are related to production losses, e.g. reduced milk yield, weight loss, impaired draught power, etc., the cost of surveillance and control programs, e.g. complete or partial condemnation of carcasses, animal culls, and trade restrictions.

Box 2. Poultry production systems, salmonellosis and highly pathogenic avian influenza

Poultry production systems are spread throughout Uganda. There are three major chicken production systems in Uganda: free-range, semi-intensive and intensive systems, with the largest share of birds raised in free-range systems.

Avian influenza viruses are highly contagious, extremely variable viruses that are widespread in water birds. Wild birds in aquatic habitats are thought to be their natural reservoir hosts, but domesticated poultry are readily infected. Highly pathogenic avian influenza (HPAI) viruses, by definition, cause severe illness in chickens and turkeys, killing up to 100% of the flock. Common clinical signs range from decreased feed and water intake, to nonspecific systemic, respiratory and/or neurological signs such as depression, edema and cyanosis of the unfeathered skin, diarrhoea, ecchymosis on the shanks and feet, and coughing, but no signs are pathognomonic. Sometimes the first sign of infection is sudden death. Human infections with HPAI virus are rare, usually occurring after prolonged close contact with infected poultry, but can result in severe illness, pneumonia, respiratory failure and death. A combination of virus isolation, serological tests, and direct antigen detection is used to diagnose HPAI infection in flocks. HPAI can spread rapidly between flocks, devastating the sector and resulting in severe trade restrictions.

Salmonellosis is a foodborne zoonotic disease caused by *Salmonella* bacteria. It is transmitted both from animals to humans and vice versa. The symptoms in humans include acute abdominal pain, diarrhoea, nausea, fever, and sometimes vomiting. When present, clinical signs in animals are similar – diarrhoea, fever and vomiting – but infection in animals is often asymptomatic. Diagnosis is based on clinical signs and isolation of the pathogen from the faeces, blood or tissues of affected animals or humans. Transmission from animals to humans is usually through consumption of contaminated food products such as meat and eggs, or contaminated plant material such as lettuce. The socioeconomic impacts in livestock (mainly in young stock) and arise from losses in productivity due to sickness. Public health costs result from reduced productivity as well as diagnosis and treatment.

The ASL2050 Expert Elicitation Protocol comprises five sections, on bovine tuberculosis, brucellosis, highly pathogenic avian influenza, salmonellosis and AMR. Each zoonotic disease section includes questions on animals as follows:

i. Number of animal cases;
ii. Number of animal deaths;
iii. Number of salvage slaughtered;
iv. Number of animal culls;
v. Percentage of underreporting in number of cases in animals;
vi. Percentage of underreporting in number of deaths in animals.

An important feature of the elicitation is that questions are asked by the different cattle and poultry production system as defined by stakeholders i.e. ranching, pastoral, agro-pastoral and semi-intensive for beef; free range, semi-intensive and intensive systems for chicken. Getting information by production system helps understand where major issues reside, i.e. where to focus the policy attention. For human beings, questions are asked for each zoonosis on:

i. Number of human cases;
ii. Number of human deaths;
iii. Number of working days lost per household per case;
iv. Average age of person affected;
v. Percentage of female affected out of total number of cases;
vi. Household expenditure per case;
vii. Government expenditure per case;
viii. Percentage of underreporting in number of cases in humans;
ix. Percentage of underreporting in number of deaths in humans.

Questions are asked by category of people, including livestock keepers, the so-called middlemen – i.e. all intermediaries working along the value chain, such as traders or labourers in processing plants – and consumers. Again, information by category of people helps narrow down the policy focus.

Finally, the Expert Elicitation Protocol includes a section on livestock-driven AMR. Questions are asked on:

i. Proportion of cattle and poultry farms using antibiotics, by production system;
ii. Trends on use of antibiotics in cattle and poultry farms by production system;
iii. Trends in antimicrobial resistance in humans;
iv. Expert's concerns on antimicrobial resistance in humans.

While asking questions is straightforward, the successful implementation of an expert elicitation depends on a number of factors like the selection of experts; a clear explanation of the protocol rationale and objectives to the experts, who should well understand they are supposed to provide their opinion and not to report the dominant narrative or official statistics; and the way questions are formulated. It is important to interpret results from protocol implementation keeping in consideration official statistics and available scientific evidence, and in consultation with stakeholders.

4. Conclusions

Livestock stakeholders in Uganda, including the government, find it challenging to design and implement zoonotic disease and AMR-related policies because of gaps in available evidence. On the one hand, neither there is systematic information on the incidence and prevalence of zoonotic diseases in animals and humans, nor on the use of antibiotics in animals and on anti-microbial resistance in humans. On the other hand, there is no any complete dataset available to quantify the returns on investments for containing and managing zoonoses and AMR, such as measured by increases in animal and labor productivity.

In Uganda, the Ministries in charge of animal and public health face what has been referred here to as "the zoonotic disease and antimicrobial resistance (AMR) information trap": they do not have information on zoonoses and AMR to make the case for getting resources for their control and management and to engage stakeholders in this endeavor. However, given the anticipated growth of the livestock sector in Uganda – and the expected novel

interactions between animals, humans and wild animals – the importance of assembling information on zoonotic diseases and AMR to start designing effective policies and programs cannot be overstated. The government should prepare now to deal with emerging public health challenges that is to ensure that possible outbreaks and spread of zoonotic diseases and AMR do not end up crippling the development of the entire country, as the avian influenza and Ebola crises stand to warn. The implementation of an expert elicitation protocol on zoonoses and AMR, if well done, represents a first step in this direction.

January 2018. The production of this document has been coordinated by Sarah Mubiru, Ana Felis (FAO) and Gerald Nizeyimana (FAO) under the guidance of the Members of the ASL2050 Uganda Steering Committee and in consultation with national livestock stakeholders.

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Appendix 1. Content of reporting forms on animal diseases

I.A. Ministry of Health Epidemiological Data Transmission

Ministry of Health, weekly district reports (MoH, 2017)

HMIS FORM 033B: HEALTH UNIT WEEKLY EPIDEMIOLOGICAL SURVEILLANCE FORM PAGE 1
Date of Report **30/03/2015** Period: From (Date) **23/03/2015** To (Date) **29/03/2015** Week No. (#) **13**
Health Unit _____ Health Unit Code _____ Sub-county _____ HSD _____ District _____

1. CASES THIS WEEK **2. DEATHS THIS WEEK**

CASES.2		**Code**	**Cases this week**	**DEATH**	**Code**	**Death this week**
1.	Malaria (total diagnosed)	**MA.**	**159**		**MA.**	**2**
2.	Dysentery	**DY.**	**1**		**DY.**	**0**
3.	Severe Acute Respiratory Infection (SARI)	**SA.**	**0**		**SA.**	**0**
4.	Acute Flaccid Paralysis	**AF.**	**0**		**AF.**	**0**
5.	Adverse Events Following Immunization (AEFI)	**AE.**	**0**		**AE.**	**0**

I.B. Ministry of Health.

National level data (regular reporting) (MoH, 2017).

CASES.		***Code***	***Cases this week***	***DEATH.***	***Code***	***Death this week***
1.	Malaria (total diagnosed)	MA.	159		MA.	*2*
2.	Dysentery	DY.	1		DY.	*0*
3.	Severe Acute Respiratory Infection (SARI)	SA.	0		SA.	*0*
4.	Acute Flaccid Paralysis	AF.	0		AF.	*0*
5.	Adverse Events Following Immunization (AEFI)	AE.	0		AE.	*0*
6.	Animal Bites (suspected rabies)	AB.	0		AB.	*0*
7.	Bacterial Meningitis	MG.	0		MG.	*0*
8.	Cholera	CH.	1		CH.	*0*
9.	Guinea Worm	GW.	0		GW.	*0*
10.	Measles	ME.	1		ME.	*0*
11.	Neonatal tetanus	NT.	0		NT.	*0*
12.	Other Viral Hemorrhagic Fevers	VF.	0		VF	*0*
13.	Plague	PL.	0		PL.	*0*
14	Typhoid Fever	TF.	0		TF.	*0*
15	Yellow Fever	YF.	0		YF.	*0*
16	Presumptive Multi Drug Resistance (MDR) TB	TB.	0		TB.	*0*
				Maternal	MD.	*1*
				Perinatal	*PD.*	*3*

I.C. Ministry of Health

Outside regularly reported diseases (MoH, 2017).

3. OTHER CONDITIONS (IF ANY): CASES

Other emerging Infectious diseases (e.g. Small pox, Influenza like Illness (ILI, SARS, etc), Ebola, number disease,…….)

	Name of 1st Condition	Cases	Name of 2nd Condition	Cases	Name of 3rd Condition	Cases
EPC.	.	.	.	.	.	

Tick upon feedback

4. OTHER CONDITIONS (IF ANY): DEATH

	Name of 1st Condition	Death	Name of 2nd Condition	Death	Name of 3rd Condition	Death
EPD.	.	.	.	.	.	

Tick upon feedback

Appendix 2. Ministry of Agriculture Animal Industry Surveillance/ epidemiological transmission templates

From MAAIF (2017).

REVISED NATIONAL ANIMAL DISEASE REPORTING FORM

THE PERMANENT SECRETARY, MAAIF,
ATT: THE EPIDEMIOLOGY UNIT,
P.O. BOX 24, ENTEBBE,
TEL: 041 321182.
Email:epireports@gmail.com

THR: **THE CHIEF ADMIN. OFFICER** …….DISTRICT

THE DISTRICT VETERINARY OFFICER ……..
Date:……./……/……

Report for the Month of ……..…Year……..

GENERAL INFORMATION

1) Rainfall Score

	Please tick	
Abundant Season rain		(4)
Sufficient Rain for significant vegetation growth		(3)
Erratic rain		(2)
Dry throughout the month		(1)

2) Water availability

Abundant		(3)
Water available in valley tanks, wells etc.		(2)
Water generally scarce		(1)

3) Grazing conditions Score

Pasture generally abundant		(3)
Pasture generally scarce.		(2)
Pasture generally very poor		(1)

Outbreaks of Contagious Diseases

Diseases	New or Follow up outbrea	Species affected	Production system	Basis for diagnosis	Name of parishes affected include Latitude longitud	Number of animals at risk	Number of cases	No. of animals dead			Month outbreak started	Control measure	Number of animals vaccinated	Laboratory confirmation ? Yes/NO
								SL	DD	DS				
Foot and Mouth Disease														
Anthrax														
Rinderpest														
Hydatidosis														
Para tuberculosis														
Bovine Tuberculosis														
Peste des Petits Ruminants														
C.B.P.P.														
Lumpy Skin Disease														
Salmonellosis														
Brucellosis														
ECF														
Babesiosis														
Anaplasmosis														
Trypanosomosis														
Blue Tongue														
Bovine Mucosal Disease														
Foot rot														
Caseous Lymphadenitis														
Sheep Mange														
African Swine Fever														

New Castle Disease														
Gumboro														
Coccidiosis														
Avian Infectious Bronchitis														
Avian Infectious Laryngotracheitis														
Fowl Cholera														
Fowl typhoid														
Avian Leukosis														
Black quarter														
Rabies														
CCPP														
Mange														
Pox														
BSE														
Orf														
RVF														

Note:

Dead-SL-slaughtered DD died DS -destroyed (killed and not consumed, buried or burnt

Basis for diagnosis-Laboratory, clinical, postmortem, owners claim, rumor

Control measures-Treatment, vaccination, quarantine, stumping out, control of wildlife reservoirs, vector control, and movement control

Production systems-intensive, mixed, extensive (pastoral & transhumance), Zero grazing, communal grazing etc

Add Avian Infectious Coryza

MEAT INSPECTION (POST MORTEM INSPECTION)

County	Parish	Abattoir/slaughter house	Species affected	Origin of animal affected:			Disease / Syndrome	Number suspected of disease	Action Taken
				District	County	Parish			
			Cattle				Tuberculosis		
							CBPP		
							Cyst Bovine		
							Hydatidosis		
							Fascioliasis		
							Others		
			Sheep				Tuberculosis		
							Hydatidosis		
							Fascioliasis		
							Cyst. tenuicollis		
							Others		
			Goats				Tuberculosis		
							Hydatidosis		
							Fascioliasis		
							Cyst. tenuicollis		
							Others		
			Pigs				Tuberculosis		
							Cyst.cellulosae		
							Trichinonosis		
							Round worm		
							Others		

Number of Cattle slaughter

Number of sheep and goats (shoats) slaughtered)

Number of Pigs slaughtered

Action Taken can be: # animals condemned or # livers trimmed or #of kidneys trimmed or # of lungs trimmed

Appendix 3. A matrix of the prioritized zoonotic diseases for Uganda (CDC Zoonotic Disease Prioritization Report)

Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
Anthrax	Bacteria	Exact numbers are unknown but cases are reported.	Anthrax is endemic in Uganda.	An effective animal vaccine and treatment for humans exists.
Zoonotic influenza viruses	Viruses	No human cases of Highly Pathogenic Avian Influenza have yet been reported in Uganda.	Uganda experienced an avian influenza outbreak in 2017.	Vaccines for swine influenza viruses available for both animals and humans. Avian influenza vaccines in development. Treatment for humans includes supportive care and antiviral agents.
Viral Hemorrhagic Fevers (Ebola, Rift Valley Fever, Crimean Congo Hemorrhagic Fever, Marburg)	Viruses	Outbreaks of multiple hemorrhagic fevers have been reported in Uganda.	Cases have been reported though exact numbers are unknown.	Currently, there are no animal vaccines. Human Ebola vaccines are undergoing clinical trials. Treatment for humans is supportive care.
Brucellosis	Bacteria	Studies indicate a >10% human seropositivity in areas within Uganda.	Cattle and goats test positive for *Brucella* within Uganda. Prevalence can be > 5%.	Vaccines are available for animals and treatment available for humans.
Trypanosomiasis	Parasite	Uganda is reporting fewer than 100 cases per year.	In Uganda, trypanosomiasis is prevalent in cattle and being spread by cattle movements.	No vaccines are available. Effective prophylactic and curative treatment is available for animals. Effective treatment for humans is available.

Plague	Bacteria	Outbreaks of plague have been reported in Uganda.	No data are available regarding the burden of plague on livestock and wildlife.	Effective human treatment is available and human vaccines are in development.
Rabies	Virus	Information on recent human cases are not available. However, the virus does circulate in Uganda.	In Uganda, rabies virus is actively circulating in dogs which are the main source of exposure for humans.	Effective animal vaccine exists and human vaccines are available. Post-exposure prophylaxis is available but treatment is not.

Source: One Health Zoonotic Disease Prioritization Workshop, 2017 March, CDC (2017).

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