



## Workshop Summary

# One Health Zoonotic Disease Prioritization for Multi-Sectoral Engagement in Uganda



Kampala, Uganda  
March 2–3, 2017



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## **PARTICIPATING ORGANIZATIONS**

Ministry of Health (MOH)

Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF)

Central Public Health Laboratory (CPHL)

Ministry of Water and Environment (MWE)

Uganda Wildlife Authority (UWA)

National Animal Disease Diagnostics and Epidemiology Centre (NADDEC)

Public Health Emergency Operation Centre (PHEOC)

Uganda National One Health Platform (including One Health Technical Working Group [OHTWG], Zoonotic Diseases Coordination Office [ZDCO])

Coordinating Office for the Control of Trypanosomiasis in Uganda (COCTU)

Infectious Disease Institute (IDI)

One Health Central and East Africa (OHCEA)

Makerere University

Uganda Medical Association (UMA)

Uganda Veterinary Association (UVA)

Uganda National Institute for Public Health (UNIPH)

Uganda Virus Research Institute (UVRI)

World Health Organization (WHO)

Food and Agriculture Organization of the United Nations (FAO)

Centers for Disease Control and Prevention (CDC)

U.S. Agency for International Development (USAID) Emerging Pandemic Threats 2 [EPT2] Program (including One Health Workforce [OHW], Preparedness and Response [P&R], and PREDICT2)

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Photo 1. Cattle in Uganda

## SUMMARY

The purpose of this two-day One Health Zoonotic Disease Prioritization workshop was to identify zoonotic diseases of greatest national concern for Uganda using equal input from representatives of human health, livestock, environment, and wildlife sectors. During the workshop, representatives identified a list of zoonotic diseases relevant for Uganda, defined the criteria for prioritization, and determined questions and weights relevant to each criterion. Seven zoonotic diseases were identified as a priority by participants using a semi-quantitative selection tool, the One Health Zoonotic Disease Prioritization tool, developed by the U.S. Centers for Disease Control and Prevention<sup>1,2</sup> (Appendix A).

The prioritized zoonotic diseases for Uganda are Anthrax, Zoonotic influenza viruses, Viral Hemorrhagic Fevers, Brucellosis, Trypanosomiasis (African Sleeping Sickness), Plague, and Rabies (Table 1). The final results of the One Health prioritization process and normalized weights for all zoonotic diseases discussed in Uganda are shown in Appendix B. This report summarizes the One Health process used to prioritize the top zoonotic diseases for Uganda that should be jointly addressed using a multi-sectoral, One Health approach including human, livestock, wildlife, and environmental sectors relevant to the prioritized zoonotic diseases.



Photo 2. Zeal of zebras, Lake Mburo National Park, Uganda.

**Table 1. Prioritized zoonotic diseases selected in Uganda during the One Health Zoonotic Disease Prioritization workshop in March, 2017.**

Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
<b>Anthrax</b>	Bacteria	Exact numbers are unknown but cases are reported. <sup>3</sup>	Anthrax is endemic in Uganda. <sup>4</sup>	An effective animal vaccine and treatment for humans exists. <sup>4</sup>
<b>Zoonotic influenza viruses</b>	Viruses	No human cases of Highly Pathogenic Avian Influenza have yet been reported in Uganda.	Uganda experienced an avian influenza outbreak in 2017. <sup>5</sup>	Vaccines for swine influenza viruses available for both animals and humans. <sup>6</sup> Avian influenza vaccines in development. Treatment for humans includes supportive care and antiviral agents. <sup>7</sup>
<b>Viral Hemorrhagic Fevers (Ebola, Rift Valley Fever, Crimean Congo Hemorrhagic Fever, Marburg)</b>	Viruses	Outbreaks of multiple hemorrhagic fevers have been reported in Uganda. <sup>8</sup>	Cases have been reported though exact numbers are unknown. <sup>9</sup>	Currently, there are no animal vaccines. Human Ebola vaccines are undergoing clinical trials. Treatment for humans is supportive care. <sup>10</sup>
<b>Brucellosis</b>	Bacteria	Studies indicate a >10% human seropositivity in areas within Uganda. <sup>11, 12</sup>	Cattle and goats test positive for <i>Brucella</i> within Uganda. Prevalence can be >5%. <sup>12</sup>	Vaccines are available for animals and treatment available for humans. <sup>13, 14</sup>
<b>Trypanosomiasis (African Sleeping Sickness)</b>	Parasite	Uganda is reporting fewer than 100 cases per year. <sup>15</sup>	In Uganda, trypanosomiasis is prevalent in cattle and being spread by cattle movements. <sup>16</sup>	No vaccines are available. Effective prophylactic and curative treatment is available for animals. Effective treatment for humans is available. <sup>15</sup>
<b>Plague</b>	Bacteria	Outbreaks of plague have been reported in Uganda. <sup>17</sup>	No data are available regarding the burden of plague on livestock and wildlife.	Effective human treatment is available and human vaccines are in development. <sup>18</sup>
<b>Rabies</b>	Virus	Information on recent human cases are not available. However, the virus does circulate in Uganda. <sup>19</sup>	In Uganda, rabies virus is actively circulating in dogs which are the main source of exposure for humans. <sup>19</sup>	Effective animal vaccine exists and human vaccines are available. Post-exposure prophylaxis is available but treatment is not. <sup>20</sup>

## INTRODUCTION

Zoonotic diseases are diseases that spread between animals and people. Most known human infectious diseases and up to three-quarters of newly emerging infections originate from animals.<sup>21</sup> Uganda is a landlocked country located between longitudes 4.20N and 1.50S; latitude 280E and 350W. The country is in a zone where seven of Africa's biogeographic regions converge. Given its location between the drier East African Savannas and moist West African rain forests, coupled with high altitude ranges, Uganda has a high level of biodiversity. It is home to more than 18,700 species of flora and fauna including 54% of the world's remaining critically endangered mountain gorillas, 24 species of primates, 11% of the world's bird species, and 7.8% of global mammal diversity.<sup>22</sup>

The human population of Uganda is growing and has reached about 36 million people. Agricultural land use especially around protected areas has resulted in increased interactions between humans, wildlife, and livestock. Furthermore, in Uganda, 80% of the population is engaged in agriculture with 58% of these individuals being involved in livestock farming.<sup>23</sup> Uganda is noted to have 11.4 million cattle, 12.5 million goats, 3.4 million sheep, 3.2 million pigs, and 39 million poultry.<sup>24</sup>

Zoonotic diseases that occur in large numbers impact Ugandan society in three main ways:

- Threaten the health of animals resulting in illness, loss of productivity, and death, and thus the livelihood of a large segment of the population dependent on livestock as a major source of income.
- Threaten national economic stability through loss of tourism, trade bans, and quarantine.

- Threaten the health of people with the ability to cause a large number of illnesses and deaths, which is associated with significant social instability and economic losses.

On 3 November 2016, the Government of Uganda launched a National One Health Platform (NOHP) to spearhead collaborative efforts amongst four government sectors to prevent, detect and respond to existing zoonotic diseases as well as emerging pandemic threats. The event was presided over by the Rt. Hon. Prime Minister. The platform is based on an inter-sectoral, collaborative, institutional framework and a Memorandum of Understanding officially signed by senior officials from the Ministries of Health; Agriculture, Animal Industry and Fisheries; Water and Environment; and the Uganda Wildlife Authority. The platform is comprised of two institutional structures—the One Health Technical Working Group (OHTWG) which provides oversight and direction, and



**Photo 3. Long-horned Ankole cattle and calves along the road, Uganda**



**Photo 4. Kampala, Uganda: skyline, hotels, and office towers**

the Zoonotic Diseases Coordination Office (ZDCO) which is the secretariat of the platform. The ZDCO is housed within the Public Health Emergency Operations Center of the Ministry of Health. The OHTWG is co-chaired by technical directors of the collaborating ministries on a six months rotational basis and has 36 members representing all the core One Health sectors, and partner organizations including United Nations agencies, United States government agencies, academia, Uganda veterinary and medical associations, research institutions, and technical partners, among others. The current rotational chair is the Director of Animal Resources. The secretariat is currently comprised of eight staff members (two from each of the sectors) who act as sector focal persons but hold positions in their respective ministries.

To best address zoonotic disease challenges in Uganda as part of the Global Health Security Agenda, a zoonotic disease prioritization workshop was held during March 2–3, 2017, at the Imperial Royale Hotel in Kampala. The goal of the prioritization process was to use a multi-sectoral, One Health approach to prioritize endemic and emerging zoonotic diseases of major public health concern that should be jointly addressed by human, animal, and environmental

health ministries and other sectors relevant to the prioritized zoonotic disease. The effort was supported by the Government of Uganda, the Centers for Disease Control and Prevention (CDC), the United States Agency for International Development (USAID), and the Preparedness and Response Project as part of the Global Health Security Agenda (GHSA).

In order to build in-country capacity to conduct future One Health prioritization workshops, three local partners were trained by CDC as facilitators and together with CDC served as the facilitators during the workshop. Thirteen facilitators representing human, animal, and environmental health sectors were trained including 10 from Uganda, 2 from Rwanda, and 1 representing the Food and Agriculture Organization of the United Nations.



## WORKSHOP METHODS

The prioritization process involved a semi-quantitative tool developed by CDC. The methods have been described in detail<sup>1,2</sup> (Appendix A). The first step of the process was to identify a country-specific list of potential zoonotic diseases of concern. A disease was selected if it was known to be passed between animals and people and thought to occur in Uganda or the surrounding region. A list of 48 zoonotic diseases, shown in Table 2 of Appendix C, was considered during the prioritization workshop. Next, the workshop participants jointly identified five criteria for quantitative ranking of these 48 diseases. Once the five criteria were chosen, each member of the selection committee individually indicated their preferences for the relative importance of each criterion to help generate a final group of weights for each criterion. The criteria and weights assigned to each criterion are listed in Appendix D.

One categorical question for each criterion was selected through group discussion. All questions had ordinal multinomial (1–5%, 5–10%, 10–20%, etc.) answers. The ordinal nature is necessary for the scoring process, and is determined by the participants and the available data. Data were identified through an extensive literature search, as well as information from WHO, OIE, ProMED, and other relevant websites. Data on incidence, prevalence, morbidity, disability-adjusted life years (DALYs), and mortality were collected for the selected zoonotic diseases. If disease information for a particular zoonotic disease was not available for Uganda, data for other East or Central African countries was used. If regional data was not available, global disease data on prevalence, incidence, morbidity, mortality, and DALYs were used. Over 100 articles were collected with disease-specific information including indicators such as prevalence,

morbidity, mortality, and DALYs for the African region. These articles were saved as PDFs, loaded onto an external storage device (USB key), and given to the workshop participants for reference.

A decision tree was designed using Microsoft Excel and used for determining the final disease ranking. Each weighted criterion was applied across all diseases, and scores were assigned based on the answer for each question. Country-specific, regional, and global data compiled previously for all zoonotic diseases under consideration were used to determine values for each question. The scores for all five questions were summed and then normalized such that the highest final score was 1. See Table 2 in Appendix C for a complete listing of normalized scores for all zoonotic diseases that were considered in the workshop.

The list of zoonotic diseases and their normalized scores was presented to the group for discussion. A panel of 9 representatives from different sectors determined a final list of 7 zoonotic diseases.



**Photo 5. Ugandan children walking home on the train tracks**

## CRITERIA SELECTED FOR RANKING ZOO NOTIC DISEASES

The criteria for ranking zoonotic diseases selected by the voting members in Uganda are listed in order of importance below (Appendix D).

### 1. The severity of disease in humans in Uganda

Diseases that cause a heavy burden in human populations were the most important criterion. Diseases with a high mortality rate (CFR >5%) received the full weight score of 1. Diseases with a lower mortality rate (CFR <5%) received a score of 0.

### 2. Availability of effective control strategies

The ability to control a zoonotic disease was the second most important criterion. Diseases where an effective control strategy to prevent a zoonotic disease for both humans and animals was available in the country were given 2 points. Diseases where an effective control strategy for either animals or humans was available, but not both, were given 1 point. In this scenario, a control strategy for either humans or animals carried the same scoring weight. Finally, diseases with no effective control strategy in humans or animals received a score of 0.

### 3. The potential to cause an epidemic or pandemic in humans or animals

Whether a disease has caused a pandemic or epidemic in humans or animals in Uganda in the prior 10 years was the third most important criterion. Diseases that have caused an epidemic in Uganda in both humans and animals received the full weight score of 2. If a disease caused an epidemic in either humans or animals, but not both, it was given a score of 1. Finally, diseases that had not caused an epidemic in Uganda were given a score of 0.

### 4. Social and Economic Impacts

Whether a disease reduced animal productivity was the fourth criterion. If the zoonotic disease reduced animal productivity by 10% or more, the disease received the full weight score of 1. If the zoonotic disease reduced animal productivity by less than 10%, a score of 0 was assigned.

### 5. Bioterrorism potential

The potential of the disease to be used for bioterrorism was the fifth criterion. If the disease was included in the United States Department of Health and Human Services and the United States Department of Agriculture Select Agents and Toxins List, the disease was given the full weight score of 1. If the disease was not included on this list, it was given a score of 0.



**Photo 6. The Grey Crowned Crane is the national bird of Uganda, featured in the country's flag and coat of arms.**

## PLANS AND RECOMMENDATIONS

After finalizing the list of priority zoonotic diseases, the workshop participants discussed recommendations and further actions that could be taken to address the prioritized zoonotic diseases. This was done in a 2-stage process. To begin, participants were asked to make general recommendations for how to approach the priority diseases without considering the constraints of their respective institution. A summary of the most prominent recommendations organized by theme follows:

### GENERAL RECOMMENDATIONS

#### Laboratory Capacity

- The Zoonotic Diseases Coordination Office (ZDCO) should map current laboratory capacity and share this information across sectors
- Obtain outside organization support to improve laboratory capacity

#### Surveillance

- Create standardized case definitions for prioritized zoonotic diseases in animals and people
- Ensure that the prioritized zoonotic diseases are included in the mandatory list of reportable diseases in all relevant sectors
- Use ZDCO as a common platform for reporting and sharing data on the zoonotic diseases in humans and animals

#### Outbreak Response

- Update existing preparedness and response plans for the prioritized zoonotic diseases if available
- Develop new One Health preparedness and response plans for prioritized zoonoses that do not currently have a written plan



#### Prevention and Control

- Strengthen multi-sectoral, One Health coordination, communication, and information sharing
- Develop a national One Health strategic plan including how to address the prioritized zoonotic diseases
- Outline current research efforts and research needs for the prioritized zoonoses across all relevant sectors for each zoonotic disease

## SPECIFIC NEXT STEPS

Finally, each government ministry involved in the decision process and the collaborating agencies who observed the process were given an opportunity to make suggestions for specific next steps to be taken to improve the multi-sectoral development of laboratory capacity, surveillance, joint outbreak response activities, and prevention and control strategies. A summary of the next steps suggested by each sector follows:

### Uganda's National One Health Platform

- Results of the One Health Zoonotic Disease Prioritization Process will be presented at the next One Health platform meeting to facilitate participation among all relevant sectors
- Operationalize the National One Health Platform Office including obtaining a permanent administrator for the National One Health Platform

### Ministry of Health

- Strengthen communication strategies around the list of prioritized zoonotic diseases
- Develop national action plans for the prioritized zoonotic diseases in collaboration with other sectors
- Work with partners to update clinical, treatment, and IDSR guidelines for human health

### Ministry of Agriculture, Animal Industry, and Fisheries

- Provide continuing education courses to front-line veterinarians on prioritized zoonotic diseases
- Work with partners to develop treatment guidelines for animal health
- Update preparedness and response plans and eradication plans using examples from neighboring countries

### Uganda Wildlife Authority

- Improve outbreak response capabilities
- Construct a new wildlife laboratory to improve diagnostic capabilities
- Enhance the role of the UWA in multi-sector surveillance of the prioritized zoonotic diseases

### Ministry of Water and Environment

- Conduct environmental impact assessments of disease control measures for the prioritized zoonotic diseases
- Provide guidelines for the safe disposal of medical waste during outbreaks for the prioritized zoonotic diseases
- Share information and data for disease prediction models for the prioritized zoonotic diseases



Photo 7. Rwenzori Mountains on the border between Uganda and the Democratic Republic of the Congo

### Research and Academic Partners

- Identify workforce training gaps and develop a training plan
- Focus research activities around for the prioritized zoonotic diseases
- Develop a One Health system to share information among partners and ministries active in the area of zoonotic diseases

### International Partners

- Re-orient laboratory capacity development to focus on prioritized zoonotic diseases
- Build capacity for surveillance and rapid response teams for the prioritized zoonotic diseases
- Support the updating of national preparedness and response plans for the prioritized zoonotic diseases
- Provide technical support and assistance on any of the prioritized zoonotic diseases
- Support development of a national One Health strategic plan for Uganda
- Support the strengthening of multi-sectoral, One Health coordination capacity



Photo 8. Food preparation in an Ugandan marketplace





Photo 9. Man selling vegetables at an outdoor market

## APPENDIX A: Five Steps for CDC’s One Health Zoonotic Diseases Prioritization Tool and Workshop

### BEFORE THE WORKSHOP

#### STEP

1

#### PREPARE FOR THE WORKSHOP

- Contact the CDC One Health Office at least 60 days before the workshop
- Work with in-country leadership to identify 8 to 12 voting members from all relevant sectors to participate in facilitated group work
- Clearly define the purpose and goal of the workshop with all sectors to be represented
- Generate a list of all endemic and/or emerging zoonoses to be considered for ranking; include input from all represented sectors
  - » Note: Involves gathering reportable diseases lists

### DURING THE WORKSHOP

#### STEP

2

#### DEVELOP CRITERIA

- Identify 5 criteria that will be used to define the relative national importance of the list of zoonoses; criteria should be locally appropriate and agreed upon by voting members

#### STEP

3

#### DEVELOP QUESTIONS

- Develop one categorical question for each of the selected criteria

#### STEP

4

#### RANK CRITERIA

- Each voting member individually ranks the selected criteria; individual scores are combined to produce an overall ranked list of criteria

#### STEP

5

#### PRIORITIZE ZOO NOTIC DISEASES

- Score each zoonotic disease based on the answers to the categorical questions for each weighted criterion using the One Health Zoonotic Disease Prioritization Tool
- Discuss next steps for multisectoral engagement for prioritized zoonoses

### WORKSHOP OUTCOMES

#### OUTCOMES

- Prioritized list of at least 5 zoonotic diseases that are agreed upon by all stakeholders at the end of the workshop
- Discussions about next steps for the prioritized zoonoses in terms of identifying areas for multisectoral engagement in developing control and prevention strategies
- Workshop summary that includes the details of the process, the list of prioritized zoonoses, and discussions and recommendations by the participants on how to jointly address capacity building, prevention, and control of prioritized zoonotic diseases
- Final report, approved by all ministries representing core voting members, within a few months of workshop completion

For more information, visit [www.cdc.gov/onehealth](http://www.cdc.gov/onehealth)

## APPENDIX B: Workshop Participants

Name	Organization	Title/Position
<b>Voting Members</b>		
Dr. Noelina Nantima	MAAIF	Assistant Commissioner, Animal Health
Dr. Deo Ndumu	MAAIF	Principal Veterinary Officer I/C of NADDEC/ZDCO
Dr. Fred Monje	MAAIF	Senior Veterinary Inspector/ZDCO
Mr. Steven Ssendagire	MOH	Epidemiologist and Team Lead, Epidemiology and Surveillance Division, Ministry of Health Headquarters, Uganda
Dr. Issa Makumbi	PHEOC/MOH	Head of PHEOC/OHTWG
Mr. Samson Okot	UWA	Environmental impact assessment Officer
Dr. Robert Aruho	UWA	Veterinarian/ZDCO
Ms. Betty Mbolanyi	MWE	Senior Environment Officer/ZDCO
Mr. Atek Kagirita	CPHL/MOH	Surveillance coordinator
Mr. Benard Erimu	UWA	Monitoring and Research Officer
<b>Observers</b>		
Mr. Joseph Muguwa	COCTU	Deputy Director
Dr. Mander Wangoola	COCTU	Program Officer
Dr. Ester Buregyeya	MakUniv-SPH	OHCEA Focal Person
Dr. Peninah Nsamba	MakUniv-COVAB/OCHEA	OHCEA Focal Person
Dr. Sarah Mubiru	FAO ECTAD	Consultant
Dr. Nanyunja Miriam	WHO	OHTWG/Disease Prevention and Control Advisor
Dr. Innocent Komakech	WHO	NPO/DPR
Dr. Benard Ssebide	PREDICT2	Country Coordinator, Uganda
Dr. Mohammed Lamorde	IDI	Project Director/OHSP
Dr. Mukuzi Muhereza	UMA	OHTWG/Medical Officer
Dr. Sylvia Baluka	UVA	OHTWG/UVA President
Dr. Innocent Rwegu	USAID OHW	Senior Technical Officer
Dr. David Mutonga	P&R	OHTWG/Regional One Health Technical Advisor
Dr. Winyi Kaboyo	P&R	OHTWG/National One Health Technical Advisor
Dr. Sarah Paige	USAID Washington	Senior Infectious Disease Advisor/EPT-2 POC Uganda
Dr. Casey Barton Behravesh	CDC Atlanta	Director, CDC One Health Office
Dr. Sean Shadomy	FAO Rome	CDC One Health Liaison to FAO
Mr. Vance Brown	CDC Kampala	Global Health Security



Name	Organization	Title/Position
<b>Facilitators</b>		
Mr. Musa Sekamatte	MOH	Epidemiologist/ZDCO/MOH
Dr. Christine Kihembo	ESD MOH	Medical Epidemiologist
Ms. Lilian Bulage	CPHL MOH	Epidemiologist
Dr. Colin Basler	CDC Atlanta	ZD Prioritization workshop facilitator
Dr. Vikram Krishnasamy	CDC Atlanta	ZD Prioritization workshop facilitator
<b>Other Participants</b>		
Dr. Juliet Sentumbwe	MAAIF	Ag. Director of Animal Resources/OHTWG chair
Ms. Sheevon Kirabo	USAID P&R	Administrative assistant
<b>Workshop Organizers</b>		
Dr. David Mutonga	P&R	OHTWG/Regional One Health Technical Advisor
Dr. Winyi Kaboyo	P&R	OHTWG/National One Health Technical Advisor
Dr. Colin Basler	CDC Atlanta	ZD Prioritization workshop facilitator
Dr. Vikram Krishnasamy	CDC Atlanta	ZD Prioritization workshop facilitator
Dr. Sarah Paige	USAID Washington	Senior Infectious Disease Advisor/EPT-2 POC Uganda
Dr. Casey Barton Behravesh	CDC Atlanta	Director, CDC One Health Office



Photo 10. People carrying milk and other goods on bicycles

## APPENDIX C: Final Results of One Health Zoonotic Disease Prioritization Workshop in Uganda

**Table 2. Zoonotic diseases considered for prioritization in Uganda: Final results of prioritization and normalized weights for 48 zoonotic diseases.**

The top prioritized zoonotic diseases selected by the voting members representing all ministries active in zoonotic disease work are shown in bold.

Rank	Zoonotic Disease	Raw Score	Normalized Final Score
<b>1</b>	<b>Anthrax</b>	<b>1</b>	<b>1</b>
<b>2</b>	<b>Zoonotic Influenza viruses</b>	<b>1</b>	<b>1</b>
<b>3</b>	<b>Ebola viruses (Viral Hemorrhagic Fever)</b>	<b>0.79439683</b>	<b>0.79439683</b>
<b>4</b>	<b>Brucellosis</b>	<b>0.79068231</b>	<b>0.79068231</b>
<b>5</b>	<b>Rift Valley fever (Viral Hemorrhagic Fever)</b>	<b>0.79068231</b>	<b>0.79068231</b>
<b>6</b>	<b>Trypanosomiasis</b>	<b>0.71082552</b>	<b>0.71082552</b>
<b>7</b>	<b>Plague</b>	<b>0.70446489</b>	<b>0.70446489</b>
<b>8</b>	<b>Crimean Congo Hemorrhagic Fever (CCHF) (Viral Hemorrhagic Fever)</b>	<b>0.70446489</b>	<b>0.70446489</b>
<b>9</b>	<b>Rabies</b>	<b>0.62052402</b>	<b>0.62052402</b>
<b>10</b>	<b>Marburg (Viral Hemorrhagic Fever)</b>	<b>0.60147853</b>	<b>0.60147853</b>
11	Salmonellosis	0.50113828	0.50113828
12	Q-fever	0.48246234	0.48246234
13	Listeriosis	0.40223599	0.40223599
14	Leptospirosis	0.39889102	0.39889102
15	Zoonotic tuberculosis	0.39889102	0.39889102
16	Bovine cysticercosis	0.39889102	0.39889102
17	Hydatidosis	0.39889102	0.39889102
18	Porcine cysticercosis	0.39889102	0.39889102
19	Newcastle disease	0.39889102	0.39889102
20	Orf (contagious ecthyma)	0.39852147	0.39852147
21	Tularemia	0.39587536	0.39587536
22	Spotted fevers	0.31230405	0.31230405
23	Tetanus	0.31230405	0.31230405
24	Leishmaniasis	0.31230405	0.31230405
25	MERS-CoV	0.31230405	0.31230405

Rank	Zoonotic Disease	Raw Score	Normalized Final Score
26	Cryptosporidiosis	0.29590466	0.29590466
27	Toxoplasmosis	0.29590466	0.29590466
28	West Nile virus	0.29590466	0.29590466
29	Lassa Fever	0.28954403	0.28954403
30	Prions	0.20931769	0.20931769
31	Ehrlichiosis	0.20597271	0.20597271
32	Trichinellosis	0.20597271	0.20597271
33	Tungiasis	0.20560317	0.20560317
34	Onchocerciasis	0.20560317	0.20560317
35	Chikungunya	0.20560317	0.20560317
36	Hepatitis E virus	0.20560317	0.20560317
37	Yellow Fever	0.20560317	0.20560317
38	Sarcoptic mange	0.20560317	0.20560317
39	Bartonellosis	0.10298636	0.10298636
40	Campylobacteriosis	0.10298636	0.10298636
41	Erysipelothrix rhusiopathiae (Erysipeloid)	0.10298636	0.10298636
42	Escherichia coli	0.10298636	0.10298636
43	Streptococcus suis	0.10298636	0.10298636
44	Tick borne relapsing fever	0.10298636	0.10298636
45	Schistosomiasis	0.10298636	0.10298636
46	Dengue Fever	0.10298636	0.10298636
47	Hantaviruses	0.10298636	0.10298636
48	Zika virus	0.10298636	0.10298636

## **APPENDIX D:** The Numerical Weights for the Criteria Selected for Ranking Zoonotic Diseases in Uganda

### **1. Severity of Disease (criterion weight=0.2093177)**

- a. What is the case fatality rate in humans?
- b. < or = 5% – 0
- c. > 5% – 1

### **2. Prevention and Control (criterion weight=0.2059727)**

- a. Is there an effective control strategy in both animals and humans?
- b. Yes, there is an effective control strategy for both humans and animals – 2
- c. There is an effective control strategy for either humans or animals – 1
- d. No, there is no effective control strategy for humans or animals – 0

### **3. Potential for Epidemic and/or Pandemic (criterion weight=0.2052336)**

- a. Has this disease caused an epidemic in animals or humans in the last 10 years in Uganda
- b. Both Yes (humans) and Yes (animals) – 2
- c. Either – 1
- d. None – 0

### **4. Social-Economic Impact (criterion weight=0.1929183)**

- a. Does the disease reduce animal productivity by 10% or more?
- b. Yes – 1
- c. No – 0

### **5. Bioterrorism Potential (criterion weight=0.1865577)**

- a. Is the disease listed as a select agent (based on USDA/HHS Select Agent List)?
- b. Yes
- c. No

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Photo 11. Little girl playing and wearing Ugandan paper bead necklaces.

