Workshop Summary

One Health Zoonotic Disease Prioritization for Multisectoral Engagement in Mozambique

Maputo, Mozambique

DEPARTMENT OF HEALTH & HUMAN SERVICES · USA

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

Public Health Institutes of the World
IANPHI

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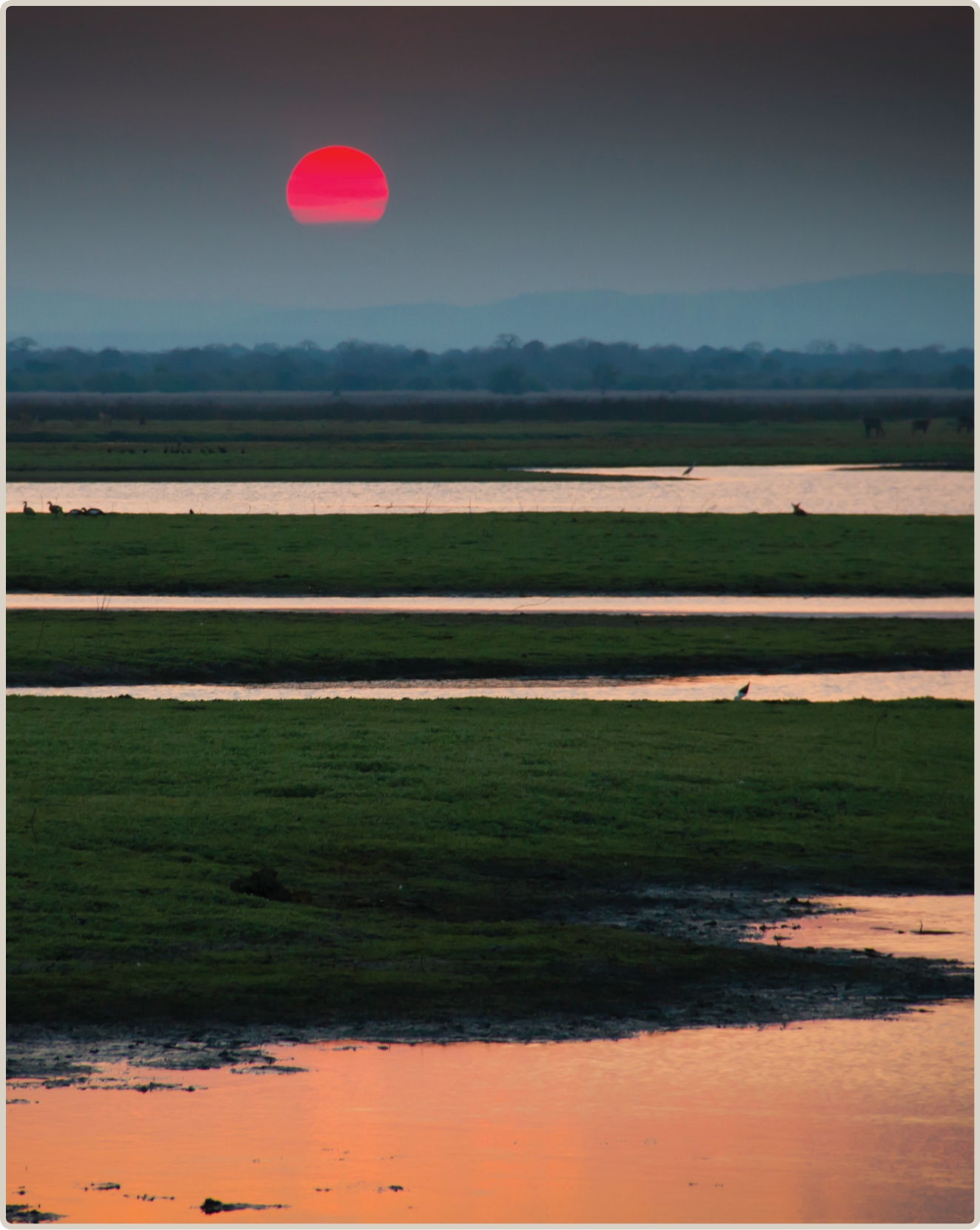

Photo 1. Sunset over the National Park Gorongosa in the center of Mozambique.

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Photo 2. Fishermen adjusting nets.

PARTICIPATING ORGANIZATIONS

- Ministry of Agriculture and Food Security (MASA), DINAV
- Ministry of Health (MISAU), INS
- Ministry of Land, Environment, and Rural Development (MITADER), ANAC
- Ministry of Sea, Inland Waters, Fisheries (MIMAIP), National Fish Inspection Institute (INIP)
- Faculty of Veterinary Medicine (FAVET), Eduardo Mondlane University (UEM)
- Directorate of Animal Sciences
- National Museum of Natural History (NMNH)
- Order of Physicians of Mozambique
- World Health Organization (WHO), Mozambique
- World Organisation for Animal Health (OIE), Mozambique
- National Public Health Institute (NPHI)
- U.S. Centers for Disease Control and Prevention (CDC)
- United States Agency for International Development (USAID), Mozambique

Photo 3. View of the Maputo skyline.

SUMMARY

The purpose of this 2-day One Health Zoonotic Disease Prioritization (OHZDP) workshop was to identify zoonotic diseases of greatest national concern for Mozambique using equal input from representatives of human health, livestock, environment, wildlife, research, development partners, and higher education sectors. During the workshop, representatives identified a list of zoonotic diseases relevant for Mozambique, 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 the OHZDP tool, a semi-quantitative selection tool developed by the U.S. Centers for Disease Control and Prevention (CDC) (Appendix A)[1, 2].

The prioritized zoonotic diseases for Mozambique are rabies virus, zoonotic tuberculosis, salmonellosis, zoonotic avian influenza virus, trypanosomiasis, brucellosis, and Crimean-Congo hemorrhagic fever (Table 1). The final results of the One Health prioritization process and the normalized weights for all zoonotic diseases discussed at the OHZDP workshop in Mozambique are shown in Appendix C. This report summarizes the One Health process used to prioritize the top zoonotic diseases for Mozambique that should be jointly addressed using a multisectoral, One Health approach including human, animal, and environmental health ministries and other sectors relevant to the prioritized zoonotic diseases.

Photo 4. One Health Zoonotic Disease Prioritization Workshop participants from human, animal, and environmental health sectors in Maputo, Mozambique.

Table 1. Prioritized Zoonotic Diseases Selected in Mozambique during the One Health Zoonotic Disease Prioritization Workshop in April 2018

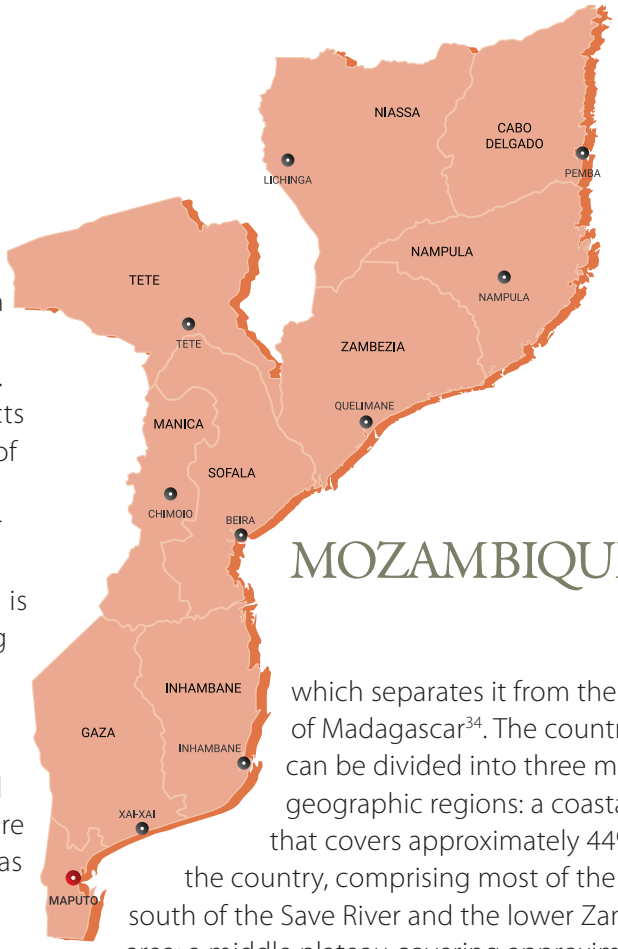
Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
Rabies	Virus	According to data submitted to OIE World Animal Health Information System, there were 72 human rabies cases in Mozambique in 2011. In 2010 there were 24 reported cases of rabies in humans. Maputo province has the highest number of human rabies cases per inhabitant, followed by the provinces of Zambezia and Nampula[3]. However, the majority of rabies outbreaks in Mozambique are not reported[4].	There is no surveillance of rabies in wildlife in Mozambique. Therefore, there have been no rabies cases confirmed in wildlife[3]. In 2010, 16 cases of rabies in dogs were reported to OIE. Three cases of rabies in dogs were reported to OIE in 2011 and 7 cases were reported in the first half of 2012[3].	In Mozambique, there are trained personnel in the veterinary sector who can perform rabies diagnostics. Mozambique has a Central Veterinary Laboratory (CVL) that is able to diagnose rabies by the following methods: FAT, DRIT, Seller's stain (Negri bodies), and molecular techniques. In addition to the CVL, Mozambique has regional laboratories in the provinces of Gaza, Manica, and Nampula. These laboratories can perform the Seller's stain diagnostic test. The human sector does not routinely perform rabies diagnosis, except in cases of requisition during investigations of suspected cases of rabies. The technique used is the Seller's stain test. An effective animal vaccine exists and human vaccines are available, albeit expensive. Post-exposure prophylaxis is available but treatment is not[5]. A human rabies vaccine for post-exposure-prophylaxis (PEP) is available at least in Maputo city. In 2010, 40.4% of people bitten by a dog received PEP[3].
Zoonotic Tuberculosis	Bacteria	In a study conducted among 110 patients suspected of having tuberculous lymphadenitis, 49 patients had a positive culture. Forty-eight of 49 patients were positive for *Mycobacterium tuberculosis*[6].	Bovine tuberculosis is a recognized problem in cattle in Mozambique. The overall prevalence of bovine tuberculosis in cattle is 13.6%, varying from 0.98% in Massingir to 39.6% in the Govuro district[9].	Mozambique does not routinely distinguish zoonotic tuberculosis from other tuberculosis species in the laboratory. Treatment is available for humans. Vaccination is available in the form of BCG for humans, but it is not an optimal animal vaccine. In animals, the disease is controlled by slaughter[10].
Salmonellosis	Bacteria	In Mozambique, rates of bacteremia in children aged 15 years or younger were as high as 120 per 100,000 persons per year[11].	In a study looking at the prevalence of diarrhea in calves in dairy farms in Mozambique, *Salmonella* spp. was isolated in 2% of all calves[12].	In the animal sector, Mozambique performs isolation in culture media and typing by agglutination test. In the human sector, molecular diagnostics are performed instead of culture and agglutination tests. Antibiotics for treatment are available in Mozambique for both humans and animals.

Zoonotic Disease	Causative Agent	Human Disease Burden	Animal Disease Burden	Diagnostics, Treatment, and Prevention
Zoonotic Avian Influenza	Virus	In a study in Maputo City looking at hospitalized children with influenza-associated severe acute respiratory infections from 2014-2016, 77 children were positive for influenza, with 33.7% typed as influenza A/H3N2 and 35.1% typed as influenza A/H1N1pdm09[13].	Overall seroprevalence of avian influenza virus was 32.6% from a sample of 439 unvaccinated and apparently healthy backyard chickens tested for presence of avian influenza virus antibodies through ELISA[14].	Mozambique has the capacity to perform molecular diagnostics in animal and human sectors. Vaccines for avian influenza virus are available for both animals and humans[15]. Treatment for humans includes supportive care and antiviral agents[16].
Trypanosomiasis (Human African Sleeping Sickness)	Parasite	No new cases of trypanosomiasis have been reported in over a decade in the following countries: Benin, Botswana, Burundi, Ethiopia, Gambia, Guinea Bissau, Kenya, Liberia, Mali, Mozambique, Namibia, Niger, Rwanda, Senegal, Sierra Leone, Swaziland, and Togo[17].	In the districts of Buzi, Mutarara, and Morrumbala, 15.1%, 10.5%, and 9.8% of all examined cattle in 2005 were infected with *Trypanosoma brucei*, respectively[18].	Both the human and the animal sectors have the capacity to diagnose trypanosomiasis. Humans are routinely diagnosed by microscopy while the animal sector uses microscopy and molecular tests. No vaccine exists for humans or animals. There is treatment for humans and animals, but availability, side effects, and the treatment regimen may limit their use[19, 20].
Brucellosis	Bacteria	In a study of brucellosis incidence among pastoralist and agro-pastoralist communities in some areas of Kenya and Tanzania, a total of 1,140 cases were found in selected study areas with an overall incidence of 22.7% (n=1140). By country, the incidence rates were 28.2% (n=578) and 17.1% (n=562) in selected areas of Tanzania and Kenya, respectively[21].	In a study assessing the status of brucellosis in and around Limpopo National Park, the brucellosis seroprevalence in buffalo was found to be 17.72% and 27.42% using Rose Bengal Test (RBT) and ELISA, respectively. Serum samples from 13 of 133 (9.77%) tested positive for bovine brucellosis using Rose Bengal Test[8].	Both the human and the animal sectors have the capacity to diagnose brucellosis. Serology and molecular testing capacity has been developed. Vaccines are available for animals[22, 23] and treatment is available for humans[24].
Crimean-Congo Hemorrhagic Fever (CCHF)	Virus	In a study investigating the occurrence of CCHF virus among febrile patients in Mozambique, 8 of 300 patients had samples that were positive for anti-CCHF virus IgG antibodies, yielding a prevalence of CCHF of 2.7%[25].	While there is no apparent disease in most animals, the hosts of the CCHF virus include a wide range of wild and domestic animals such as cattle, sheep, and goats[26]. Despite the existence of some evidence of virus circulation in humans, no studies so far have been developed on CCHF virus in Mozambique for animals.	Mozambique is able to diagnose CCHF virus in humans by serology and molecular tests. There is currently no capacity for animal testing. There is no vaccine available for humans or animals[26].

INTRODUCTION

Zoonotic diseases are diseases that are spread between animals and people. Most known human infectious diseases and about three-quarters of newly emerging infections originate from animals. Mozambique is particularly vulnerable to the effects of zoonotic diseases because approximately 81% of the country's labor force is involved with agriculture[27]. The country has a population of over 26.5 million people, with 45% of the population being younger than 15 years old[27]. The population is clustered into three large populations found along the southern coast between Maputo and Inhambane, in the central area between Beira and Chimoio along the Zambezi River, and in the northern cities of Nampula, Cidade de Nacala, and Pemba. The least populated areas of the country are the northwest and southwest [27]. Mozambique is has 1,914,498 cattle; 3,457,162 goats and sheep; 1,595,238 pigs; 147,097 rabbits; and 18,004,442 poultry (primarily chickens, as well as ducks, geese, turkeys, and guinea fowl). Mozambique is home to many species of wildlife, with 26% of the country covered by Conservation Areas, including three National Reserves and a National Park[29]. Mozambique has more than 6,000 plant species and more than 4,000 animal species, with 726 species of birds including 29 globally threatened species[30], as well as 214 species of mammal[29] including populations of 16,000 elephants, 12,000 sable antelope, 350 African wild dogs, and more [31]. Mozambique's marine ecosystems include 194 species of coral and a huge diversity of other invertebrate marine wildlife[29, 32] which includes a large shrimping fishery, 18 species of marine mammals, and 2,626 species of marine fish[29] supporting at least 285,000 fishers across more than 1,500 fishing centers[33].

Mozambique is bordered by Tanzania to the north, Eswatini to the south, South Africa to the southwest, and Zimbabwe, Zambia, and Malawi to the west. To the east, the country is bordered by the Channel,



which separates it from the island of Madagascar[34]. The country can be divided into three main geographic regions: a coastal belt that covers approximately 44% of the country, comprising most of the areas south of the Save River and the lower Zambezi area; a middle plateau covering approximately 29% of the country; and a plateau and highland region with average elevations of approximately 1,000 meters to the north of the Zambezi River, covering about 29% of the country's landscape[35]. Mozambique's climate varies from tropical and subtropical conditions in the north and central parts of the country to dry, semiarid steppe and a dry, arid desert climate in the south[35]. The hottest regions are located in the Zambesi basin, the coastline of Cabo Delgado, Nampula, Sofala, and Zambezia[35]. The south is the coolest part of the country, with an average maximum temperature of 30 degrees Celsius and a minimum temperature of 19 degrees Celsius[36]. Coastal temperatures are high for much of the year while the interior is warm to mild, even in the cooler, dry season that occurs from April to September. In the south, the hot and humid rainy season occurs from December to March[36]. Farther north, the aforementioned period is lengthened by a few weeks. Coastal northern Mozambique's climate is occasionally affected by tropical cyclones. Mozambique is usually sunny throughout the year [36].

Approximately 62 million hectares of land in Mozambique are covered by natural vegetation, consisting of high forest (0.8%), low forest (13.8%), thicket (43.4%), wooded grasslands (19.5%), and mangroves (0.5%). The total cultivable land is estimated at 36 million ha (45% of the total area of the country)[35].

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

- Threaten the health of animals resulting in illness, loss of productivity, and death.
- Threaten the livelihood of a large segment of the population dependent on livestock as a major source of income.
- Threaten the health of people with ability to cause a large number of illnesses and deaths, which is associated with significant social and economic losses.

To begin addressing zoonotic disease challenges in Mozambique, an OHZDP workshop was held April 26-27, 2018, at the Centro Internacional de Conferéncias Joaquim Chissano in Maputo.

Photo 5. View of Maputo, Mozambique.

The purpose of this 2-day workshop was to use a multisectoral, One Health approach to identify zoonotic diseases of greatest national concern for Mozambique. The specific goal of the prioritization process was to use a multisectoral, 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 Mozambique, CDC, and the International Association of National Public Health Institutes (IANPHI).

To build in-country capacity to conduct future OHZDP workshops, CDC trained 15 local partners on the use of the OHZDP tool and facilitation: Ministry of Health (MISAU) INS (n=4), Ministry of Agriculture and Food Security (MASA), DINAV (n=4) and DCA (1), Ministry of Land, Environment and Rural Development (MITADER) (n=3), and Ministry of Sea, Inland Waters and Fisheries (MIMAIP) (n=3). Six of the 15 trained participants, who represented human, animal, and environmental health sectors, served as the facilitators during the workshop (MISAU: n=2, MASA: n=2, MITADER: n=2). Additionally, 8 of the 12 voting members attended the entire OHZDP facilitator training, which allowed the voting members to have a detailed understanding of the tool, contributing to an efficient workshop.

WORKSHOP METHODS

The prioritization process involved a semi-quantitative tool developed by CDC. The methods have been previously described in detail (Appendix A)[1, 2] . 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 Mozambique or the surrounding region. A list of 48 zoonotic diseases, shown in Appendix C, was considered during

Photo 6. Mountain peaks in rural northern Mozambique.

the prioritization workshop. Next, the workshop participants jointly identified five criteria for quantitative ranking of these 48 zoonotic 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 either binomial (yes/no) or 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 Mozambique, data for other countries in the region were used. If regional data were not available, global disease data on prevalence, incidence, morbidity, mortality, and DALYs were used. Over 900 articles were collected with disease-specific information on prevalence, morbidity, mortality, and DALYs for the country, region, and globally. These articles were saved as PDFs and given to the workshop participants for reference.

A decision tree was designed with 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 response to each question. Country-specific, regional, and global data compiled previously for all zoonotic diseases under consideration were used to determine appropriate responses for each question. The scores for all five questions were summed and then normalized such that the highest final score was 1. See Appendix C for a complete listing of normalized scores for all zoonotic diseases considered in the workshop.

The list of zoonotic diseases and their normalized scores was presented to the group for discussion. A panel of 12 representatives from different sectors voted on a final list of seven zoonotic diseases (Appendix C).

Photo 7. Food vendors at an open market.

Criteria Selected for Ranking Zoonotic Diseases

1. **Disease occurrence on a regional and local level, and pandemic or epidemic potential**

   The first ranked criterion was the occurrence of the disease in Mozambique or neighboring countries and evidence of sustained human-to-human transmission. Diseases that occurred locally or regionally with evidence of sustained human-to-human transmission received a score of 3. Diseases that occurred locally or regionally but did not have sustained human-to-human transmission received a score of 2. Diseases that did not occur locally or regionally but had sustained human-to-human transmission received a score of 1. Diseases that did not occur locally or regionally and had no evidence of sustained human-to-human transmission received a score of 0.

2. **Morbidity and mortality**

   The second ranked criterion was morbidity and mortality in humans. Diseases that had a case fatality rate of greater than or equal to 10% received a score of 4. Diseases that caused long-term disability AND had a case fatality rate of less than 10% received a 3. Diseases that did not cause long-term disability AND had a case fatality rate of less than 10% received a score of 2. Diseases that caused long-term disability AND had a case fatality rate of 0 received a score of 1. Diseases that did not cause long-term disability AND had a case fatality rate of 0 received a score of 0.

   [When scoring these criteria, the worst-case scenario for case fatality rate was used if it was found in the literature. If not, the overall case fatality rate was used from global data. If no information on long-term disability was available, disability adjusted life years (DALYs) were used. For those diseases that did not have DALYs available, sequelae were assessed to determine if potential for long-term disability existed.]

3. **Capacity of laboratory diagnostics and epidemiological surveillance**

   The third ranked criterion was the existence of in-country laboratory capacity and epidemiologic surveillance for the human health AND/OR animal health sectors in Mozambique. Diseases that had both laboratory and surveillance capacity for humans AND animals received a score of 2. Diseases that had either laboratory OR surveillance capacity for humans OR animals received a score of 1. Diseases that had no laboratory or surveillance capacity for neither humans OR animals received a score of 0.

Photo 8. Mozambican dhow at sunset.

4. **Availability of resources and mechanisms for collaboration, prevention, treatment, and eradication of the disease**

   The fourth ranked criterion was the availability of resources and mechanisms for collaboration, prevention, treatment, and eradication of the disease in Mozambique. Diseases that had a treatment and/or vaccine available in country for at least one sector AND a response plan in at least one sector received a score of 2. Diseases that had a treatment and/or vaccine available in country for at least one sector OR a response plan in at least one sector received a score of 1. Diseases that had no treatment or vaccine available in country AND no response plan received a score of 0.

5. **Social-economic and environmental impact**

   The fifth ranked criterion was the social, economic, and environmental impact of the disease. Diseases that were on the World Organisation for Animal Health (OIE) reportable disease list received a score of 1. Diseases that were not present on the OIE list received a score of 0.

   [The OIE list was agreed upon by the voting members as a proxy to measure socio-economic impact.]

PLANS AND RECOMMENDATIONS

General 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:

One Health Coordination Mechanisms (leadership, technical level)

- Proposed a One Health coordination mechanism at the technical level with the sectors present from this workshop to formalize communication mechanisms for sharing outbreak and other priority data
- Attempt to integrate additional ministries into International Health Regulation planning
- Establishment of a One Health Unit/Center
- Implement One Health partnerships at national and international levels

Surveillance

- Developing a zoonoses surveillance manual in the One Health approach
- Prepare and review the Standard Operational Procedures, Protocols for General Surveillance and Response, and Priority Diseases

- Hire consultancy services for the design and implementation of the online platform for analysis and integrated data sharing between national and international sectors and partners
- Define the tools for mapping high-risk areas to the occurrence of priority zoonotic diseases
- Carry out expeditions of research on the occurrence of priority diseases and the enrollment of their potential reservoirs and hosts and other associated factors

Laboratory Capacity

- Multisectoral, collaborative scientific research will be pursued with a focus on one or more of the five prioritized diseases.
- Train technicians in zoonotic diseases diagnosis in humans and animals through national and international partnerships
- Acquire laboratory equipment and supplies for the routine diagnosis of priority diseases in regional or reference laboratories for animal and human health

Photo 9. A pair of Impala grazing.

Outbreak Response

- Training courses for human and animal sectors using One Health approach
  - First training: cover the principles of outbreak investigation and ethical conduct of research
  - Second training: cover the type of questionnaires and different ways of administering them. The two questionnaires (one for human subjects and the other for livestock) that must be used, and because they are going to be administered in person, professional and cultural sensitivities must be discussed in detail.
  - Third training: train how to assemble a team and preparation of the supplies needed

Preparedness Planning

- Devise a mechanism to share existing and future plans with appropriate ministries in a One Health approach
  - Example: When a plan for avian influenza is being shared with ministries to ensure there is a method for awareness around existing plans.

Workforce

- Approve curricula for continuing training in zoonotic diseases under the One Health concept
- Conduct theoretical and practical trainings using a multisectoral, One Health approach
- Carry out awareness campaigns for animal health professionals to join the Field Epidemiology and Laboratory Training Program (FELTP) and other programs

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 that ministries could take to improve the multisectoral 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:

Ministry of Health (MISAU)

- Sending out an invitation to coordinate the One Health Committee among the present ministries at the workshop
- Integrate additional ministries into International Health Regulations planning
- Coordinate the implementation of the activities described in Global Health Security Agenda

Ministry of Agriculture and Food Security (MASA)

- Identify appropriate points of contact within their ministry to be involved in the One Health committee
- Coordinate the implementation of the activities described in Global Health Security Agenda (GHSA)

Ministry of Land, Environment, and Rural Development (MITADER)

- Identified a point of contact to identify appropriate points of contact within their ministry to be involved in the One Health committee
- Strengthen the surveillance system for zoonotic diseases in wildlife
- Implement pilot studies for zoonotic disease in areas of conservation with high occurrence of zoonotic diseases

Ministry of Sea, Inland Waters, and Fisheries (MIMAIP)

- Identified a point of contact to identify appropriate points of contact within their ministry to be involved in the One Health committee
- Expand activities linked to routine surveillance of Salmonella in fish
- Implement research lines related to zoonotic diseases affecting aquatic animals
- Train technical staff in modules of zoonoses, especially those affecting fish

Photo 10. Silhouette of a boy dancing at sunset.

Research and Academic Partners

- Establish memorandums of understanding between Eduardo Mondlane University-Centro de Biotecnologia, Instituto Nacional da Saúde, Instituto Superior de Ciências de Saúde and other institutions that deal with zoonotic diseases to train professionals in courses with zoonoses modules
- Establish memorandums of understanding with research institutions at the international level

International Partners

- U.S. Centers for Disease Control and Prevention:
  - Technical support in the implementation of the GHSA plan
- IANPHI
  - Technical and financial support in the implementation of the GHSA plan

APPENDIX A: Overview of the One Health Zoonotic Disease Prioritization Process

U.S. Centers for Disease Control and Prevention: Overview of the One Health Zoonotic Disease Prioritization Workshop
https://www.cdc.gov/onehealth/global-activities/prioritization-workshop.html

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 ZOONOTIC 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

Photo 11. Voting members during the One Health Zoonotic Disease Prioritization Workshops.

Photo 12. Participants of the One Health Zoonotic Disease Prioritization Workshops.

APPENDIX B: One Health Zoonotic Disease Prioritization Workshop Participants for Mozambique

Voting Members

Name	Title/Position	Organization
Eduardo Samo Gudo	PhD/ Deputy Director at the Instituto Nacional de Saúde	Ministry of Health
Vanessa Monteiro	MD/ Clinical Coordinator for acute fever surveillance at the Instituto Nacional de Saúde	Ministry of Health
Sadia Ali	BSc, MSc/ Coordinator of Vector-borne, Neglected, and Zoonotic Diseases at Instituto Nacional de Saúde	Ministry of Health
Ana Bela dos Machangos	DvM, MSc/ Head of the Department of Disease Prevention and Control at the National Veterinary Directorate	Ministry of Agriculture and Food Security
Fernando Rodrigues	DVM/ Focal point for zoonotic diseases at the National Veterinary Directorate	Ministry of Agriculture and Food Security
Sara Juma Achá	DVM, MSc/ Head of the Veterinary Central Laboratory at Directorate of Animal Sciences	Ministry of Agriculture and Food Security
Aurora Muzima	DVM/ Technician	Ministry of Land, Environment and Rural Development
Alda Zita Manhiça	Technician	Ministry of Land, Environment and Rural Development
Pedro Magaia	Technician	Ministry of Land, Environment and Rural Development)
Sónia Gemo	DVM/ Inspector at the National Fish Inspection Institute	Ministry of Sea, Inland Waters, Fisheries
Saquibibi Valgy Ibraimo	DVM/ Inspector at the National Fish Inspection Institute	Ministry of Sea, Inland Waters, Fisheries
Rosário Hermínio	DVM/ Inspector at the National Fish Inspection Institute	Ministry of Sea, Inland Waters, Fisheries

Observers

Name	Title/Position	Organization
Dercília Arone	OIE, Mozambique	OIE, Mozambique
Israel Gebresillassie	WHO, Mozambique	WHO, Mozambique
Lionel Nizigama	WHO, Mozambique	WHO, Mozambique
Alfredo Mc-Arthur	USAID	USAID
Daniel Singer	CDC, Mozambique	CDC, Mozambique
Belisário Moiane	FAVET, UEM	FAVET, UEM
Cândido Faiela	DCB, UEM	DCB, UEM
Lourenço Mapaco	DCA	DCA
Álvaro Vetina	NMNH	NMNH

Facilitators

Name	Title/Position	Organization
Almiro Tivane	BSc, MSc/ National Coordinator of Zoonoses Technical Group in Mozambique and Emerging and Reemerging Infectious Disease of Laboratory Director at INS	Ministry of Health- National Public Health Institute (INS)
Inocéncio Chongo	DVM/ Focal point of Emerging and reemerging infection disease (zoonotic disease) at the INS	Ministry of Health- National Public Health Institute (INS)
Florência Cipriano	DVM/ Head of Epidemiology Department at the National Veterinary Direction	Ministry of Agriculture and Food Security
Ilda Nhanombe	DVM/ Technician at the National Veterinary Direction	Ministry of Agriculture and Food Security
Felício Fernando	MSC/ Technician	Ministry of Land, Environment and Rural Development
Nilsa Racune	MSC/ MITADER Technician	Ministry of Land, Environment and Rural Development
Grace Goryoka	Health Scientist	CDC, One Health Office
Nadia Oussayef	Public Health Analyst	CDC, One Health Office
Nick Schaad	Epidemiologist	CDC, Center for Global Health
Kate Varela	Veterinary Medical Officer	CDC, One Health Office

Additional Key Staff

Name	Title/Position	Organization
Neusa Nguenha	Biologist/ Laboratory Technician	Ministry of Health- National Public Health Institute (INS)
John Oludele	Microbiologist/ Laboratory Technician	Ministry of Health- National Public Health Institute (INS)
Plácida Maholela	DVM/ Laboratory Technician	Ministry of Health- National Public Health Institute (INS)
Albert Nicolau	DVM/ Laboratory Technician	Ministry of Health- National Public Health Institute (INS)

Workshop Organizers

Name	Title/Position	Organization
Alfredo Vergara	Country Director	CDC Mozambique
Dan Singer	Health Informatics and Systems Support Branch Chief	CDC Mozambique
Eduardo Samogudo	Deputy Director	National Institute of Health, Ministry of Health, Mozambique
Almiro Rogério Tivane	BSc, MSc/ National Coordinator of zoonoses technical group in Mozambique and Emerging and reemerging infection disease of Laboratory Director at INS	National Institute of Health, Ministry of Health, Mozambique
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Photo 13. A flock of flamingos in flight by the shore.

APPENDIX C: Zoonotic Disease List Considered in One Health Zoonotic Disease Prioritization Workshop and Resulting Scores

Zoonotic diseases considered for prioritization in Mozambique: 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.

#	Disease	Raw Score	Normalized Final Score
1	**Rabies Virus**	**0.891414034**	**1**
2	**Zoonotic Tuberculosis**	**0.891414034**	**1**
3	**Salmonellosis**	**0.823191527**	**0.923467093**
4	Babesiosis	0.821489343	0.92155756
5	Echinococcosis/hydatidosis	0.821489343	0.92155756
6	**Zoonotic Avian Influenza Virus**	**0.821489343**	**0.92155756**
7	**Trypanosomiasis (Human African Sleeping Sickness)**	**0.819958877**	**0.919840664**
8	**Brucellosis**	**0.819856057**	**0.919725318**
9	Cysticercosis	0.819856057	0.919725318
10	**Crimean-Congo Hemorrhagic Fever**	**0.788695459**	**0.88476895**
11	Plague	0.751839191	0.843423103
12	Anthrax	0.750034186	0.841398224
13	Nipah	0.717240302	0.804609614
14	Schistosomiasis	0.714708383	0.801769273
15	Yellow Fever	0.714708383	0.801769273
16	Leptospirosis	0.714708383	0.801769273
17	West Nile Virus	0.680109494	0.762955784
18	Rift Valley Fever	0.680109494	0.762955784
19	Q-Fever	0.680109494	0.762955784
20	Leishmaniasis	0.678579029	0.761238888
21	Colibacillosis	0.644783691	0.723326834
22	Listeriosis	0.644783691	0.723326834
23	Toxoplasmosis	0.643150405	0.721494592
24	Trachoma	0.608620415	0.682758394
25	Hantavirus	0.574858999	0.644884394
26	Campylobacteriosis	0.573225713	0.643052152
27	Swine Erysipelas	0.573225713	0.643052152
28	Zoonotic Swine Influenza	0.573122892	0.642936806
29	Onchocerciasis	0.571695248	0.641335256
30	Lyme Disease	0.501770556	0.562892816

#	Disease	Raw Score	Normalized Final Score
31	Trichinellosis	0.501770556	0.562892816
32	Pasteurellosis	0.501667735	0.56277747
33	Middle East Respiratory Syndrome (MERS)	0.500068371	0.560983283
34	Severe Acute Respiratory Syndrome (SARS)	0.468873852	0.52598886
35	Ebola	0.464742568	0.521354332
36	Glanders	0.461407098	0.517612557
37	Tularemia	0.461407098	0.517612557
38	Lassa Fever	0.394817877	0.442911892
39	Japanese Encephalitis Virus	0.391482406	0.439170117
40	Western Equine Encephalomyelitis	0.391482406	0.439170117
41	Eastern Equine Encephalomyelitis	0.391482406	0.439170117
42	Variant Creutzfeldt-Jakob Disease	0.391482406	0.439170117
43	Old World Screwworm	0.38984912	0.437337875
44	Avian Chlamydiosis	0.356156603	0.399541166
45	Marburg	0.356156603	0.399541166
46	Venezuelan Equine Encephalitis	0.319924428	0.358895435
47	New World Screwworm	0.318291142	0.357063194
48	Camelpox	0.105250495	0.118071391

Photo 14. Limestone formations in Nampula Province, Mozambique.

APPENDIX D: The numerical weights for the criteria selected for ranking zoonotic diseases in Mozambique

1. **Disease occurrence on a regional and local level, and pandemic or epidemic potential (criteria weight = 0.3257)**
   - Does the disease occur in Mozambique or neighboring countries in humans or animals, and is there evidence of sustained human-to-human transmission (pandemic potential)?
     - Occurs locally or in neighboring countries, and there is evidence of sustained human-to-human transmission – 3
     - Occurs locally or in neighboring countries, and there is no evidence of sustained human-to-human transmission– 2
     - Does not occur locally or in neighboring countries, but there is evidence of sustained human-to-human transmission– 1
     - Does not occur locally or in neighboring countries, and there is no evidence of sustained human-to-human transmission– 0
2. **Morbidity and mortality (criteria weight = 0.2862)**
   - Does laboratory capacity and/or epidemiological surveillance exist for the human health and/or animal health sector in Mozambique?
     - Both laboratory and surveillance capacity exists for humans and animals – 2
     - Some form of laboratory or surveillance capacity exists for humans or animals – 1
     - No laboratory or surveillance capacity exists for neither humans or animals – 0
3. **Capacity of laboratory diagnostics and epidemiological surveillance (criteria weight = 0.1429)**
   - What are the morbidity and mortality rates of the disease in humans?
     - Case fatality rate ≥ 10% – 4
     - Long-term disability (Yes) and case fatality rate <10% – 3
     - Long-term disability (No) and case fatality rate <10% – 2
     - Long-term disability (Yes) and case fatality rate is zero – 1
     - Long-term disability (No) and case fatality rate is zero – 0
4. **Availability of resources and mechanisms for collaboration, prevention, treatment, and eradication of disease (weight = 0.1398)**
   - Is there a response plan for the disease in Mozambique and is there a vaccine or treatment available in the country?
     - A response plan exists in at least one sector in country and a vaccine and/or treatment is available in country for at least one sector – 2
     - A response plan exists in at least one sector in country OR a vaccine or treatment is available in country for at least sector – 1
     - No response plan exists in country and no vaccine or treatment is available in country – 0
5. **Social, economic, and environmental impact of the disease (weight = 0.1052)**
   - Is the disease on the OIE reportable disease list?
     - Yes – 1
     - No – 0

Photo 15. A scuba diver swims close to a giant grouper fish in Mozambique's Indian Ocean.

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Photo 16. Meluli river at dusk in Nampula Province, Mozambique.

Photo 17. A rice farmer working her field in Xai Xai, Mozambique.

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